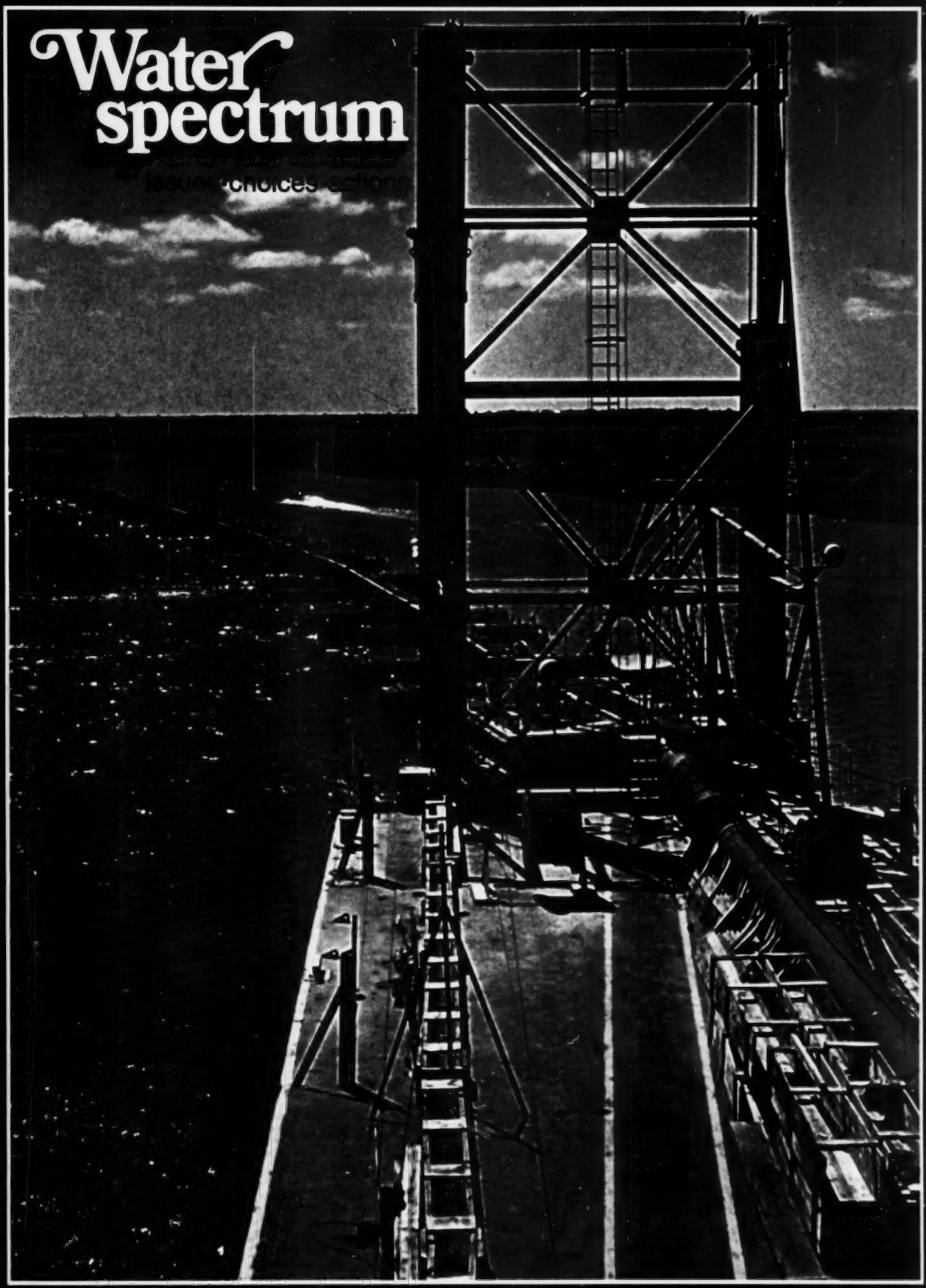
Water spectrum

issues choices actions



DEPARTMENT OF THE ARMY, CORPS OF ENGINEERS

Vol. 6, No. 3, 1974

issues · choices · actions

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Address changes: Please attach old address label to request for changes.

Opposite-To meet the continuing requirement for efficient maintenance of the Nation's commercial waterways, a tow of offices, quarters and equipment moves to a worksite.

COVER
New research probes alternatives for disposal of dredged material. *See page 26.*

A Prediction for Spectrum

When we first published Water Spectrum in 1969, the Secretary of the Army said he anticipated that it would grow to assume a leading role in the water resources communication field. And this issue, my last one as editor, is an occasion for a few observations on that prediction.

As I look at articles that appeared during the magazine's formative years, the single feature prevailing throughout is the timeliness of what authors discussed. They have foreseen new water resource developments, giving an early alert to what would be coming over the horizon.

For example, Spectrum began in the days when the economic cost/benefit ratio reigned supreme in decisionmaking. Even so, in the very first issue Dr. Stanley A. Cain of the University of Michigan School of Natural Resources projected and defended this conclusion: "Evidence is accumulating that technical ecological information is as fully important an input in almost everything we do in the resources field as are economics and engineering."

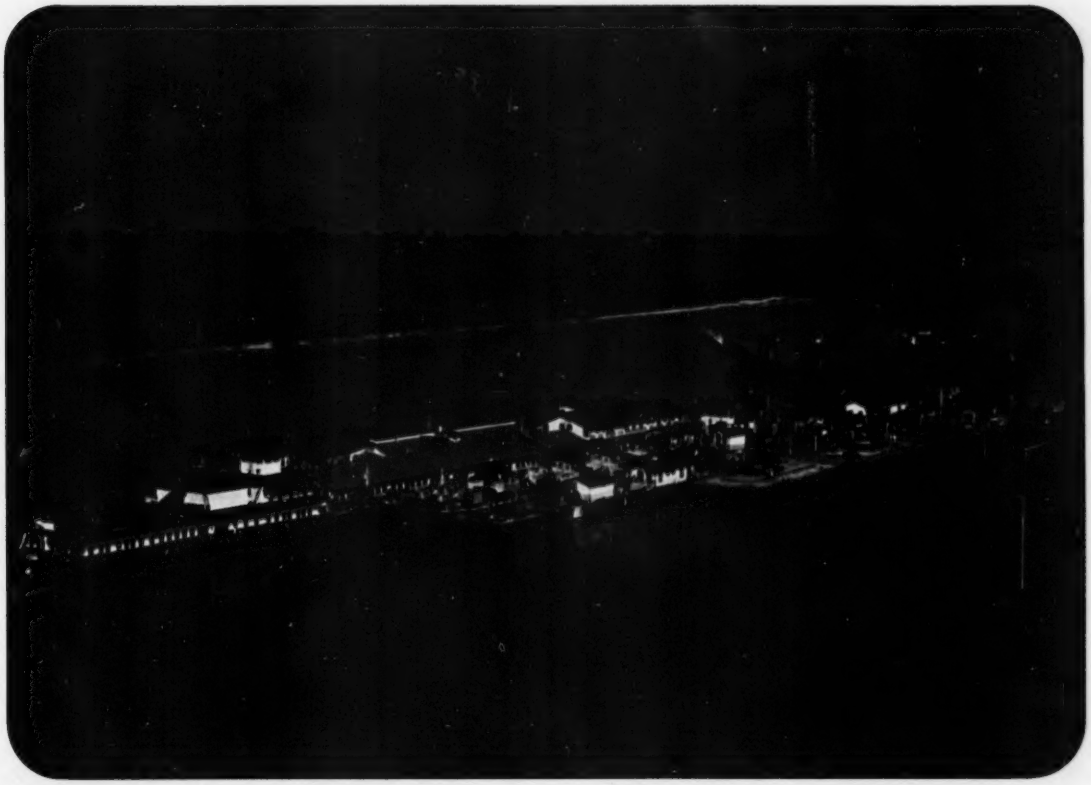
Ecological-environmental considerations have moved strongly to the fore in water resources management in recent years. Their advancement was greatly stimulated by the conceptualization and implementation of multiple-objective planning, a pioneering advance instigated by the Corps of Engineers. A series of Spectrum articles explored the major ramifications of this type of planning, including its implications for public participation in the decisionmaking process for future use of water resources. The transition from theory to full application was completed in 1973, when the National Water Resources Council issued new "Principles and Standards," and Warren Fairchild, Executive Director, told Spectrum readers how economic and environmental values would henceforth receive parity treatment. As the Nation faces the challenge of giving these values equal status, I think you can count on Spectrum to bring you the views of those who perform the studies, conduct the research, apply the findings.

You may recall the recent era when most towns, cities and government officials seemed inclined to ignore land disposal of wastewater as a viable alternative. Not Spectrum authors though. They were reporting on the pilot planning projects for metropolitan wastewater management, which included land disposal as a valid choice. Other authors documented the conditions under which land disposal would be the most sensible method.

Among them was Dr. Tom Hinesly, a soils ecologist at the University of Illinois, who made this observation: "Despite the intensity of current feelings on the subject, the near future will surely witness the gradual reuse of wastewater nutrients on the land in preference to continuing disposal into flowing water and landfills." He added, "Impetus for such a drastic change in attitude will form out of an evolving realization that standard disposal practices

Continued on inside back cover

The Corps' first venture into water management occurred in 1824, making 1974 a 150th anniversary and a special time for the Chief of Engineers to take stock of past experience as well as contemplate how to meet changing public needs. This year is also marked as the time of Senate Public Works Committee overview hearings on Corps civil functions, and this article is based on the Chief's statement at the opening session.



PERSPECTIVES

on the Army Engineers Water Management Mission

by Lt. General W. C. Gribble, Jr.

Since their inception into the Civil Works Program in the 1930s, hydroelectric power projects have grown to 61 operating plants, generating 71 billion kilowatt-hours of energy in the last fiscal year.

The Corps of Engineers has played a key role in water resources development in the United States for 150 years. Corps responsibilities date back to 1824 and 1857, respectively, for improvement of inland navigation and coastal harbors. Initial flood control authorities were provided in 1917 for the Mississippi and Sacramento Rivers and were expanded to a nationwide scope in 1936.

Hydropower came into the program during the 1930s with the construction of the Bonneville and Ft. Peck projects in the West. In 1944, Congress established a nationwide policy for hydropower and added major drainage to our flood control mission. At that time, Congress also provided the first general authority to develop the recreation potential created by our reservoir projects, and in 1946 established a national program for public benefit to protect coastal shores from erosion.

These multiple objectives were further expanded in 1958 to include water supply, hurricane flood protection, and fish and wildlife enhancement. Two years later, a program for providing flood plain hazard information was initiated. During the next decade new responsibilities were assigned with regard to urban water supply planning and were significantly broadened in 1970 to include consideration of comprehensive wastewater management systems and solutions to water quality problems induced by strip-mining operations. And Congress, in the Water Resources Development Act of 1974, provided us with a number of new program authorities, some of which I will discuss here.

Civil Works Accomplishments

The Corps of Engineers is a nationwide organization of over 39,000 employees, of which 30,000 are primarily associated with the Civil Works Program. This program is managed thru the Office of the Chief of Engineers and two supporting organizational levels. The first is composed of 14 division engineer offices, 11 of which have civil works responsibilities. These offices supervise the second level—the district engineer offices, which are the primary executive and operational units of the organization. There are 39 districts, 36 of which have civil works responsibilities.

A brief summary of the results of the Civil Works Program will indicate its scope to date.

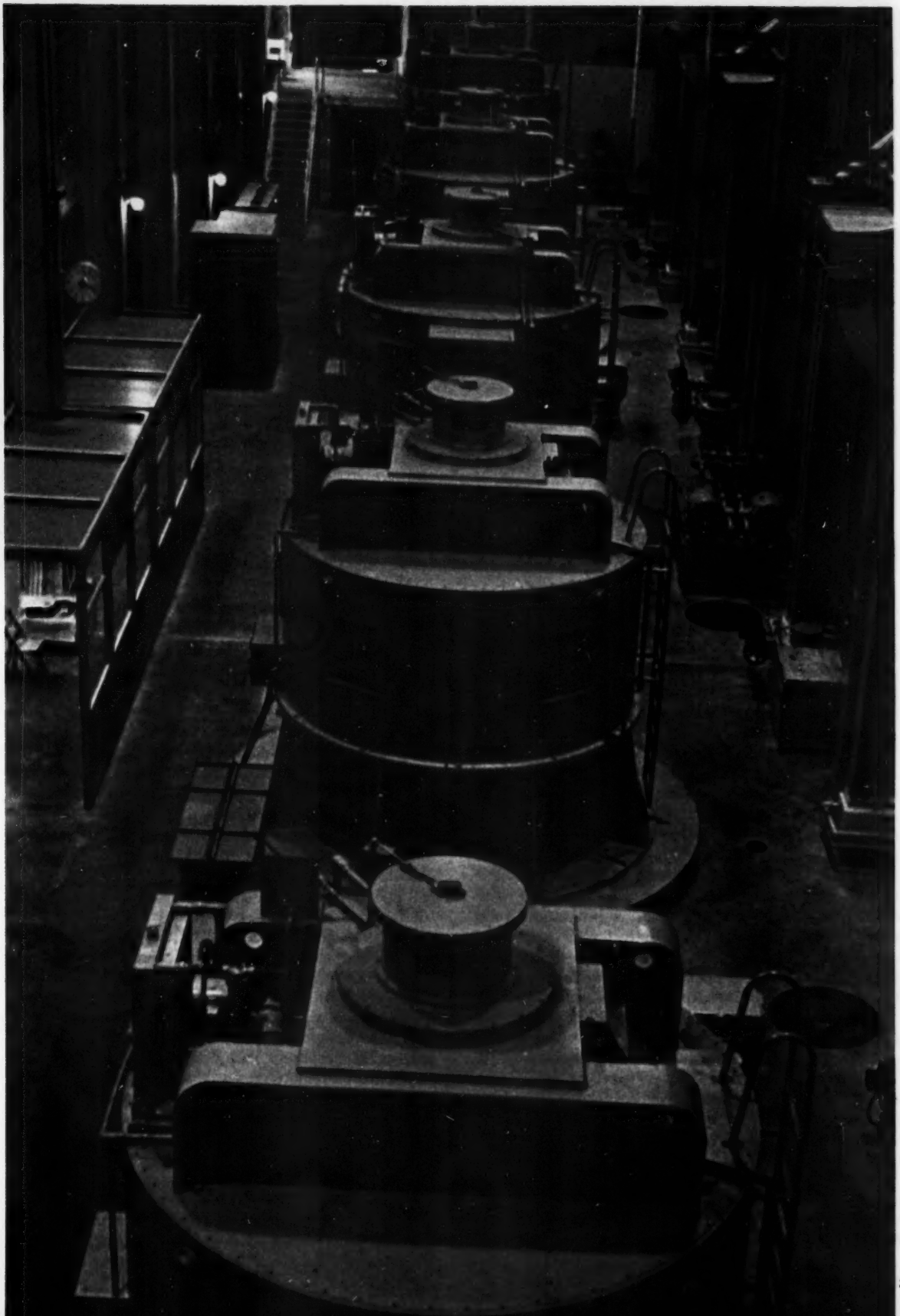
- Nearly 3,400 projects and project modifications have been completed for the multiple purposes previously mentioned.
- The flood control and multiple purpose projects have prevented damages of nearly $38 billion, providing a return of $3 for every dollar of investment.
- Last year a sixth of intercity transport, over 350 billion ton-miles of cargo, was carried on the harbors and improved waterways provided by Corps projects.
- There are now over 2 trillion gallons of water supply storage in our reservoirs, which could supply as many as 4.5 million people on a continuing basis.
- Some 14.5 million kilowatts of capacity are installed in 61 operating hydroelectric power projects. Marketing of this capacity and the related 71 billion kilowatt hours of energy generated at these projects resulted in revenues of $165 million in fiscal year 1973.
- There were 344 million visitor days of recreation at our projects in 1973—greater than attendance at lands and facilities of any other Federal agency.

There are presently under construction 282 projects and modifications, including the Mississippi River and Tributaries Projects for flood control. Their total construction cost is currently estimated at $22 billion. There are 332 more projects included in our active backlog estimated to cost about $12 billion. In addition, there are about 600 other authorized projects which are classified as either inactive or deferred for restudy.

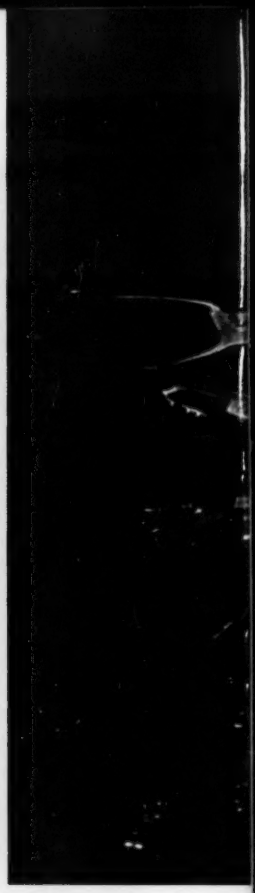
Current Program Developments

The Civil Works Program has a history of contributions of truly substantial proportions to the Nation's development, economic security, and welfare. Today there appear to be many opportunities for further help to the American society.

For example, the energy problem continues to preoccupy the country, and the Corps is working in a variety of ways to contribute to its resolution. The current construction budget gives top priority to completion of hydroelectric projects and aims for the earliest possible power-on-the-line dates for new facilities. We are investigating the potential for including additional generating facilities at power projects which are in operation, at projects which are authorized, as well as possibilities for new authorizations. Also, an in-depth analysis of the inland waterways system is underway, with particular attention being given to ways to enhance movements of cargo, a majority of which includes energy fuels and products. In addition, studies have been made



Below-In some cases where development has already occurred in flood hazard areas, floodwalls offer the most practical protection. Right-Corps reservoirs now store more than 2 trillion gallons of water to meet municipal, industrial, agricultural and other needs.



of the need for offshore deep port facilities which might be determined necessary to implement national energy policy; and work is underway to develop criteria to guide the effective and safe operation of such facilities. Furthermore, priority is being given to processing those permit applications that involve energy-related facilities.

In addition to working directly on problems of national concern, the Corps is devoting an increasing share of its planning capabilities to help State and local authorities to develop programs for water resources management in accordance with their own priorities. For example, 28 urban studies are underway covering major metropolitan areas. The primary aim of these studies is to help provide information needed by State and local officials who must not only relate solutions to urban water problems (such as flood control, water supply and wastewater management) to each other, but to other urban problems (such as open space requirements, neighborhood renewal and transportation) as well.

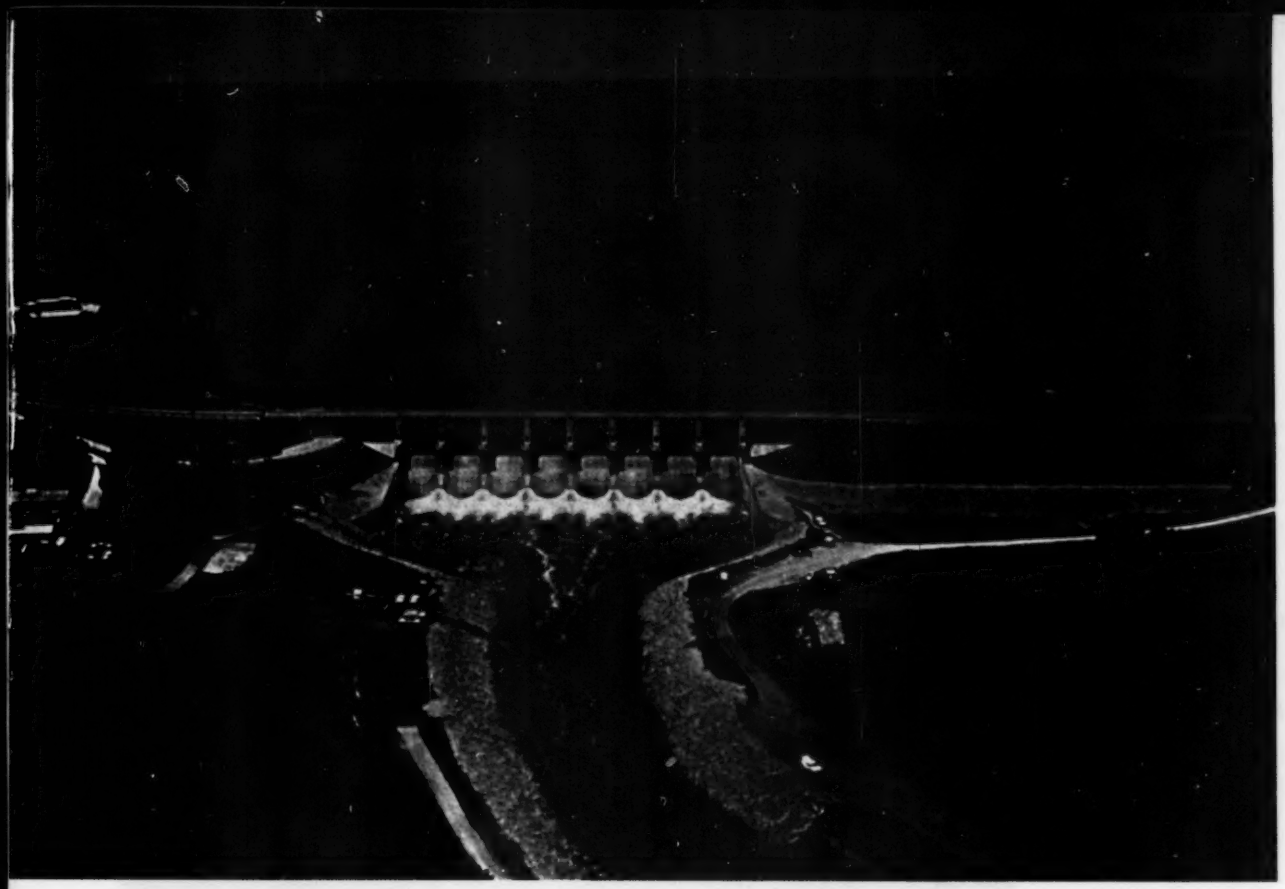
In many of the urban studies, alternative wastewater solutions are being developed to meet the requirements of the Federal Water Quality Act Amendments of 1972. This is being done so that State and local officials will be able to determine which system is best suited to a given area, and to permit them to obtain funds from the Environmental Protection Agency (EPA) to design and construct wastewater treatment facilities.

The flood plain management services program demonstrates both a most welcome growth in public understanding of flood phenomena and a growing requirement for Corps planning assistance. Programs of flood plain management highlighting land-use regulations as a key to solving the problem now are underway in many States and hundreds of communities. Each year has seen an increase in the program through which we provide flood plain information and related planning and technical guidance.

Services to States and agencies through this program will continue to mount, as will our contributions to the Federal flood insurance program. Under this program assistance is provided to communities thru the Federal Insurance Administration in the delineation of flood prone areas. The Congress has indicated that this activity is to receive the highest "practicable priority," and we anticipate even further increases in the already large volume of requests for assistance under this program.

Another important area of interagency and intergovernment collaboration on water resources planning and development pertains to the coastal zone. The Coastal Zone Management Act of 1972 makes coastal States responsible for preparation of comprehensive coastal zone management plans. We are preparing to assist the designated States' planning agencies in many important respects, including helping them apply sophisticated remote sensing technology to data collection and interpretation efforts.

The Water Resources Development Act of 1974 authorized a number of new activities for which implementing guidelines and criteria are now being developed. Section 22 authorizes the Corps to cooperate with any State in preparing its own comprehensive intrastate basin plan. This "effort sharing" authority



should help greatly to insure responsiveness to State planning priorities. Sections 32, 54 and 55 authorize the development of new technical assistance plans to combat shoreline and streambank erosion problems, including innovative demonstration projects. Section 73 provides for Federal participation in the full range of potential solutions to flood control management problems, including nonstructural elements.

Section 12 provides a highly important deauthorization authority for assisting us in eliminating any public concern that the Corps might undertake water resource projects conceived in a bygone era under outmoded standards. Under this authority, the Secretary of the Army will submit an annual report proposing the deauthorization of projects. These will be projects which have not been funded in the preceding 8 years and which no longer have public support or are considered unresponsive to contemporary standards and future needs. The first of these reports, which will be fully coordinated with State and Federal agencies, will be submitted early next year.

Current Challenges

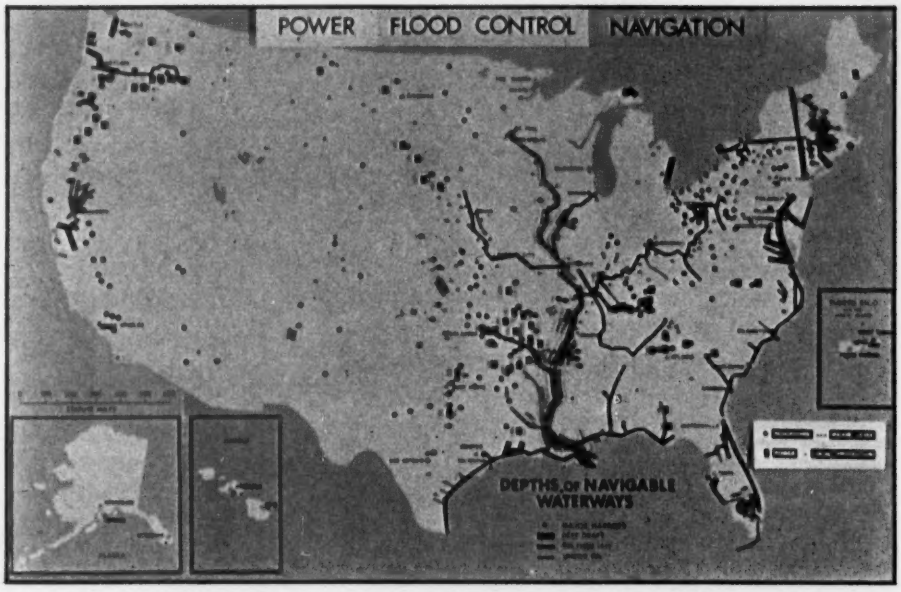
I would now like to address several current problem areas that constitute important challenges to the Corps in carrying out its Civil Works Program.

We face two major problems in dredging operations: first, that of conducting dredging in an economical and environmentally suitable manner; and second that of mobilizing sufficient dredge capacity to meet the growing needs for construction and maintenance of projects where a special dredge plant is required. Over the past few years, increased public awareness of environmental values has led the Corps to devote more attention to the environmental aspects of dredging and disposal practices. Passage of Public Law 92-500—the Water Pollution Control Act Amendments of 1972—and Public Law 92-532—the Marine Protection, Research and Sanctuaries Act of 1972 (Ocean Dumping Act)—has established stringent and complicated requirements in connection with disposal of dredged material.

We have published proposed regulations setting forth appropriate procedures. It is still too early to tell what specific issues may arise, but unquestionably the problems of meeting environmental standards will be present for some years. Among these problems is the effect that additional dredging costs required to meet the newly established guidelines and criteria will have both on construction of new projects and maintenance of existing projects.

Because of the importance of dredging and disposal operations to the Corps program, we are giving high priority to an extensive, ongoing dredged material study. This study is providing more definitive information on the environmental impact of dredging and disposal practices. We fully expect the study to result in identifying more economical practices—and perhaps more important—to demonstrate ways in which dredged material can be used constructively to improve environmental conditions and produce economic benefits.

At the present time we are faced with an acute situation in regard to our hopper dredging capacity. For the



This map shows locations of some of the major Corps civil works activities.

Breakwaters reduce the force of waves, thus protecting beaches and beachfront structures from wave-induced damage.

most part, our equipment is quite old—with an average age of 25 years—and an urgent need is developing to modify or replace equipment in order that it can perform efficiently and reliably.

At the direction of the Appropriations Committees, we are conducting a comprehensive study of national dredging requirements and capacity—including both Federal and non-Federal sectors. This study will provide an overview of workload requirements and an evaluation of the type, condition and suitability of plant now operated by the dredging industry and the Corps of Engineers. It will also indicate the type and number of dredges which will be needed in the near-term future. When completed, the study should provide the Congress with the basic information necessary to determine the future role of the Federal Government in the dredging field.

Recent years have seen a major expansion in regulatory permit programs, coupled with a greatly increased complexity of issues involved. This has been the result of broadened regulatory concepts and the requirements of new legislation.

Historically, the decision to issue a permit for work in navigable waters rested almost entirely on the effect of that work on navigation. Pursuant to requirements of recent Federal legislation—as interpreted by court decisions and our regulations—this decision is now based on

Corps projects provide a variety of recreational activities, and the annual number of visitor days has reached the 344 million mark.

Hurricane barriers, such as this horseshoe-shaped structure, protect residential, commercial and industrial property from hurricane flood damage.

whether the proposed activity is in the public interest. This requires an analysis of a wide range of factors, including environmental concerns. In addition, our definition of "navigable waters of the United States" has been revised to incorporate recent judicial definitions of this term, and has resulted in the inclusion of many waterbodies which have not previously been subject to our jurisdiction.

New legislation has also increased the scope and complexity of the Corps regulatory permit program. The Federal Water Pollution Control Act Amendments of 1972 requires the Corps, in coordination with the Coast Guard, to review all discharge permit applications filed with EPA or the States for their impact on navigation and anchorages. EPA has estimated receipt of about 200,000 such applications. In addition, this law requires Corps permits for the discharge of dredged or fill material into navigable waters. It also imposes certain procedural and substantive review requirements in the processing of these permit applications. The Marine Protection, Research and Sanctuaries Act of 1972 (Ocean Dumping Act) extended our jurisdiction to discharge of dredged material in ocean waters, and imposed similar procedural and substantive review requirements.

The number of permit applications annually processed by the Corps has grown from about 8,000 several years ago to an estimated 17,000 this fiscal year.

Corps beach restoration projects, such as this one, are carried out in cooperation with local jurisdictions.

Enactment of the National Environmental Policy Act (NEPA) has had a profound effect on the Civil Works Program. The act hastened recognition of the environmental quality aspects of our planning, construction, and operation and maintenance activities. It has required the development of new expertise in setting forth the impacts of our program on the natural ingredients for long-term quality of life. NEPA also has given us an intimate acquaintance with injunctions, court orders, appeals and lawyers.

NEPA is basically a good statute that was long overdue. Its goals are valid and essential, although some of its administrative procedures are cumbersome and time consuming. Properly done, an environmental study should be part of the basic planning process. There should be no need for a separate document with separate review, comment and processing once we get through the initial backlog of projects that were planned before NEPA came into existence.

I believe that the Corps' performance under NEPA has been responsive and will continue to improve with additional experience. We have written over 1,500 environmental impact statements. The result is that 338 studies or projects have been altered as of mid-1974. There have been 42 NEPA lawsuits on construction projects: of these, 9 have been halted, construction is proceeding on 16 while court action is underway, and suits have been concluded on 15—all in our favor.

The Water Resources Council's Principles and Standards became effective on October 25, 1973, and the discount rate provisions were modified by Section 80 of the Water Resources Development Act. The Council and the affected Federal agencies are working toward a consistent set of procedures for interpretation and application of the Principles and Standards. A draft Engineer Regulation has been furnished to our field offices for interim guidance pending a Water Resources Council determination regarding its consistency with the Principles and Standards.

Survey reports submitted to the Congress this year will have an addendum that supplies abbreviated information reflecting the new standards. All survey reports submitted after June 30, 1975 will be in full compliance with the new standards.

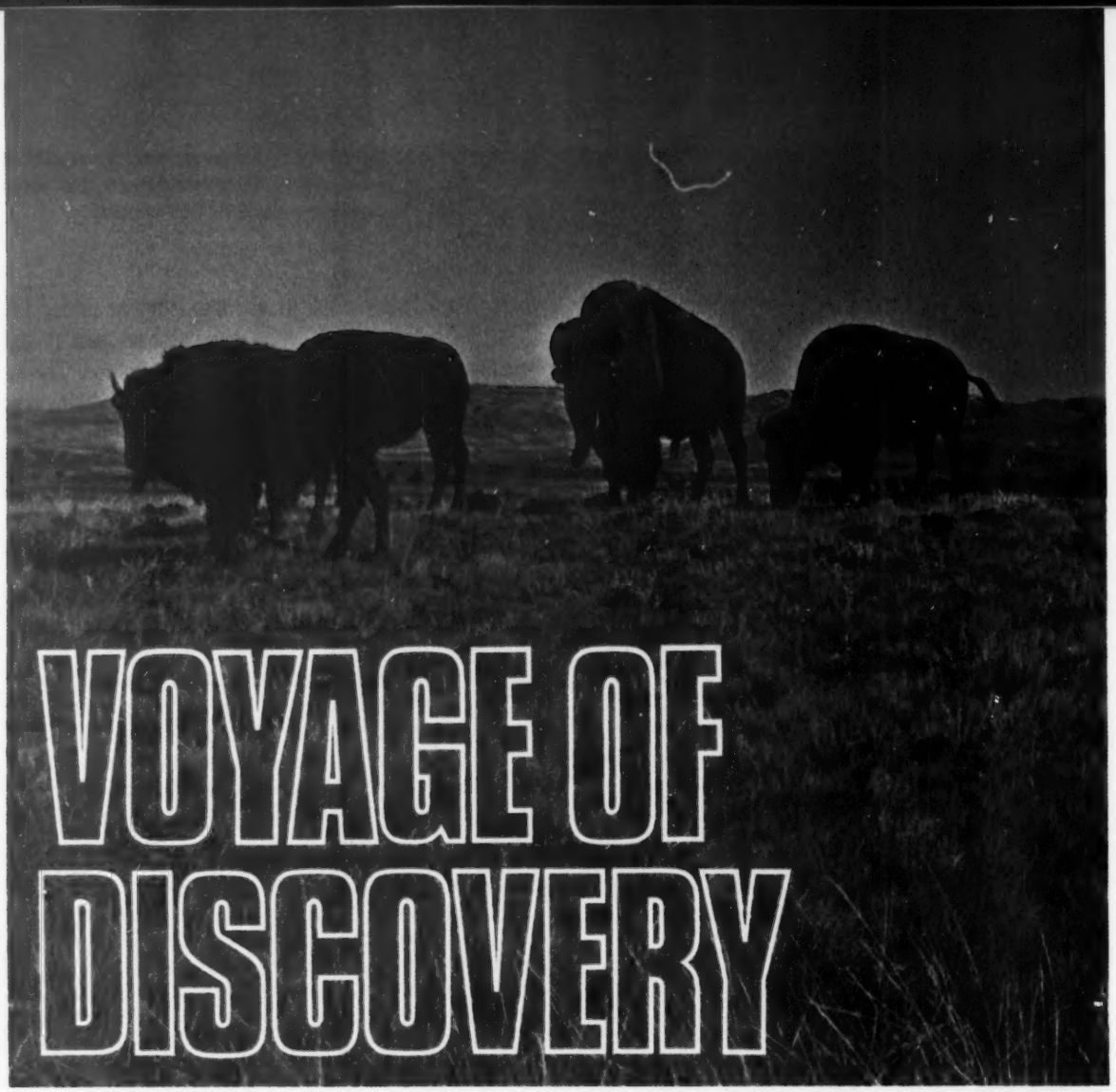
Incorporation of the new standards into planning procedures is a difficult and challenging task. Consideration must be given to a wider range of alternative solutions to land and water problems, a greatly expanded set of potential project effects will have to be investigated, and greater reliance will be placed on public participation in formulation and evaluation of proposed measures. We fully expect, however, that the results of our efforts will be project recommendations that more fully meet the emerging needs of our country.

Conclusion

The historical record of accomplishment under the Corps Civil Works Program has been substantial and responsive to the expanding needs of our Nation. The investments in water resource projects already built have been repaid many times over. Flood control works have brought security from the ravages of floods to hundreds of cities and towns and saved the alluvial valley of the Mississippi from disastrous overflows—most recently demonstrated by last year's experience. Deep-draft harbors have opened the cities of our seacoasts and Great Lakes to the flow of international commerce, and inland waterways have linked vast internal regions together through an effective low-cost transportation system. Hydroelectric installations have provided a clean source of power at low cost to millions, utilizing a renewable resource. Water supply storage has provided for municipal, industrial and agricultural development and serves as an invaluable insurance against drought conditions. Beneficial effects of the investments made have played an important role in development of major regions of the Nation such as the Ohio, Arkansas and the Columbia River Basins.

Completion of the active program included for planning and construction in the fiscal year 1975 budget request will add significantly to those achievements. The benefits that will be produced by those projects included in that budget are estimated to exceed $5 billion annually—including $2.8 billion from flood control, $1.1 billion from navigation and $650 million from power. Other benefits will accrue from provisions for such multiple uses as water supply, recreation, erosion control, and providing an opportunity for fuller utilization of unemployed or underemployed resources in depressed areas.

In the years ahead, the Civil Works Program will evolve in response to the objectives of meeting national needs for economic growth and enhancing environmental quality in a balanced way. The body of knowledge and experience that the Corps of Engineers has developed in its century and a half of civil works performance will continue to grow and be applied responsibly in public service. ■



VOYAGE OF DISCOVERY

by Dudley D. Rehder

The time—1804. President Jefferson consummated the controversial Louisiana Purchase only 1 year ago. Now he has directed a small expedition, under Captains Meriwether Lewis and William Clark, to find out just what he bought. This is the "Voyage of Discovery" which will cover the Missouri River all the way to its headwaters before reaching the Pacific Coast.

As the expedition passes through this vast land, huge herds of buffalo cover the prairies. Elk, antelope and deer, as well as buffalo, supplement the larder. From the Journals of Lewis and Clark we read:

> "Buffalo and elk and deer is . . . plenty. Beaver is in every bend. I observed the magpie, goose, duck and eagle all have their nests in the same neighborhood."

Buffalo, elk, deer, antelope, waterfowl—passive and active, belligerent and benign—men on the Lewis and Clark expedition saw it all.

The time—the 1970s—early summer. You are the explorers. The kids are out of school. You are on your family vacation. Come to the Heartland of America—in the middle of it all. Cross the Missouri and discover the Gateway to the West. Follow Lewis and Clark.

This is the Missouri River Basin, home of the U.S. Army Corps of Engineers' Missouri River Division. It is a region whose very size taxes the imagination today as it did in 1804. It is 529,000 square miles, an area about a sixth of the contiguous 48 States, and it includes all or parts of 10 States—Montana, Wyoming, Colorado, North Dakota, South Dakota, Minnesota, Nebraska, Kansas, Iowa and Missouri.

It is a land of contrasts. Rainfall averages within the basin range from 6 inches in the High Country to more than 50 inches near the mouth of the Missouri. Temperatures range from 60 degrees below zero to more than 120 degrees above.

Has the basin changed since Lewis and Clark embarked on their "Voyage of Discovery?" The answer is a resounding YES!

Their adventure opened the door to fur trappers and traders who moved their goods by canoe, rowboat and finally the picturesque paddle wheelers. The steamboat, in turn, brought the homesteaders. Soon the surrounding prairies were dotted with domestic livestock. Military posts appeared. Gold was discovered. Railroads were built.

Mr. Rehder is Chief, Recreation-Resources Management Branch, Construction-Operations Division, in the Corps' Missouri River Division.

No longer do the thundering herds of buffalo stampede across the prairie like a huge blanket being pulled across the earth. Today their roaming habits are restricted to private, State and Federal lands where sophisticated animal husbandry practices are maintained.

has it changed? Today the basin produces two-thirds of the wheat, half the cattle and a fourth of all feed grains in the Nation. It has changed, but the price was high.

The awesome herds of buffalo, the abundant elk, the grizzly and the bighorn sheep dwindled from plentiful to rare to almost nonexistent. Their trails, beaten rock hard in the lush grass of the Midlands, gave way to modern highways twisting serpentine throughout the basin.

Has it changed? Six Corps of Engineers dams on the main stem converted the capricious Missouri from a rampaging killer into a benign neighbor for the 8 million persons living in the basin today.

The change, or rather the succession of changes, in the basin resulted from an evolution in American mores. We passed through several eras, each a moment in the psychological and physical development of the Nation.

These eras are outlined by Dr. Douglas F. Gilbert in his book *Public Relations in Natural Resources Management.* He divided the sequential changes in handling natural resources into fairly definite eras.

The first—lasting until the mid-19th century—can be termed the Era of Abundance, a time when we worried little about the supply of natural resources. "There is more of everything around the next bend or over the next ridge."

From 1850 until the dawn of the present century we experienced the Era of Exploitation—"Cut out, get out, kill off and fish out." This was the period of market hunting, the time of depletion and destruction.

Following this was the era we could call Preservation and Production which lasted until mid-Depression, about 1935. The period was marked by ratification of international waterfowl treaties, introduction of the Duck Stamp, establishment of refuges and hatcheries, stocking of game and bounty laws.

As this era drew to a close, we approached the ecological Era of Harvest and Habitat Management. The principles continue today even though we are embarking on the next period which could be called the Era of Human Management.

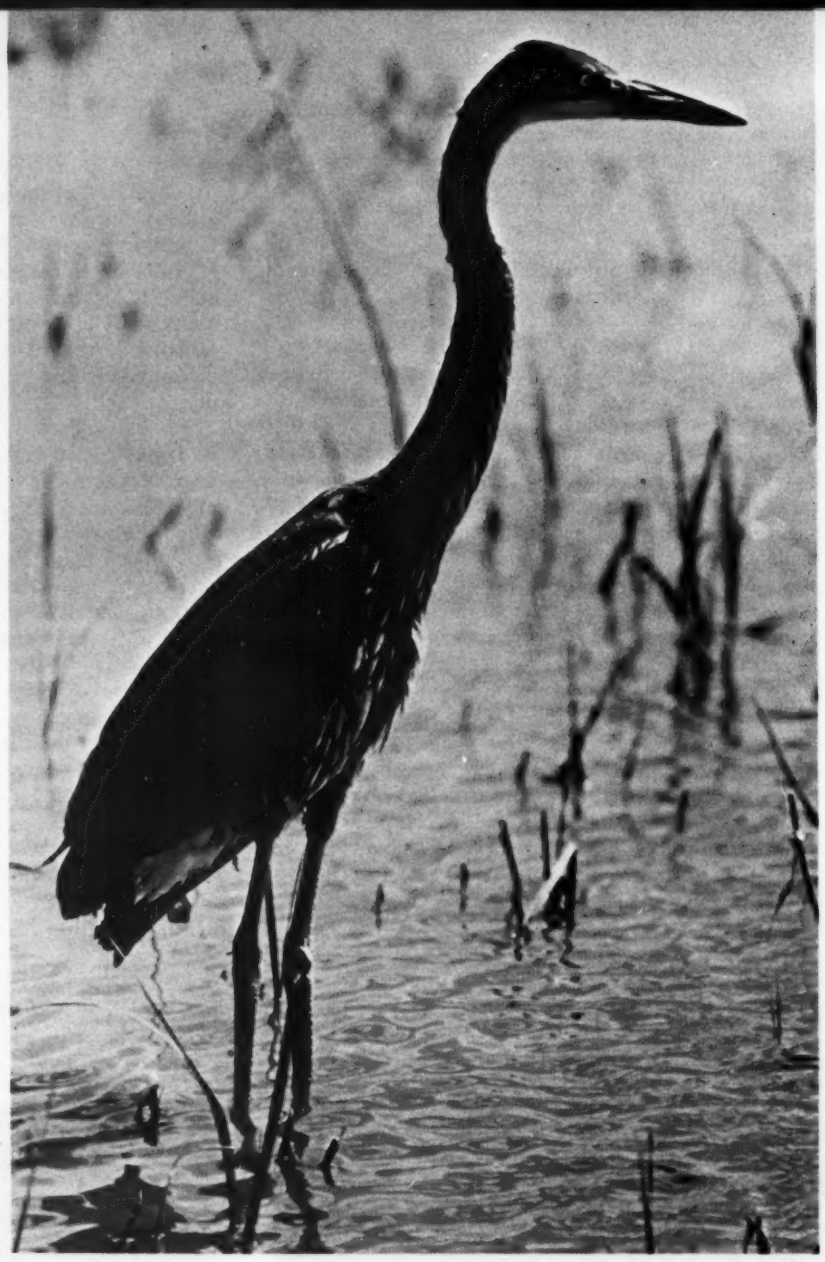
Although they believe in the need for and the soundness of managing natural resources, many professional natural resources managers today recognize that we may have neglected management of the *users* of our resources.

What of tomorrow? Here is where you and your family, the explorers of the 70s, come into the picture. Now is the time when your role as a parent can be crucial in guiding your children's futures, in forming their attitudes toward life and living things, and now is the moment when you play a vital role in preserving the virtues and enhancing the values of this land which so impressed Thomas Jefferson's emissaries.

But, tell it like it is.

The black-footed ferret is an endangered species whose survival depends on the well-being of the prairie dog—a staple item in its diet.

This blaireau or burrowing dog of the prairie as described by Lewis and Clark has suffered a substantial decline in population through indiscriminate poisoning programs. Although not now endangered, the prairie dog is given special attention on Corps lake project areas.



This long legged wader is a common visitor to the shallow water areas of Corps lakes. At the Chatfield Lake Project near Denver, Colo., special efforts have been taken to preserve an established heron rookery.

If you are like most parents, you tell them time and again just how good they have it. You regale them with tales of the Olden Days when things were really tough—studying by coal oil lamp (even if you didn't do your sums on the blade of a wooden shovel), the simple pleasures of going to town for groceries and supplies (beef jerky and hardtack, maybe?). Bet you dwell on the fact that you didn't even have television!

But, what are the kids to believe? In the next breath you tell of the Good Old Days—the fun of "swimmin' in the crick;" shooting a full bag of quail, pheasant, duck or goose; catching your limit in a crystal clear lake or stream that was never crowded.

"That's the way we were," according to the song, but is it? Yes, we had great times in the woods, the fields and the streams in the Good Old Days but, in a sense, it's like the rope swing in the hayloft of the Big Red Barn when you were a 10-year-old. The size, sound, smells and colors are magnified as we look at them through the years.

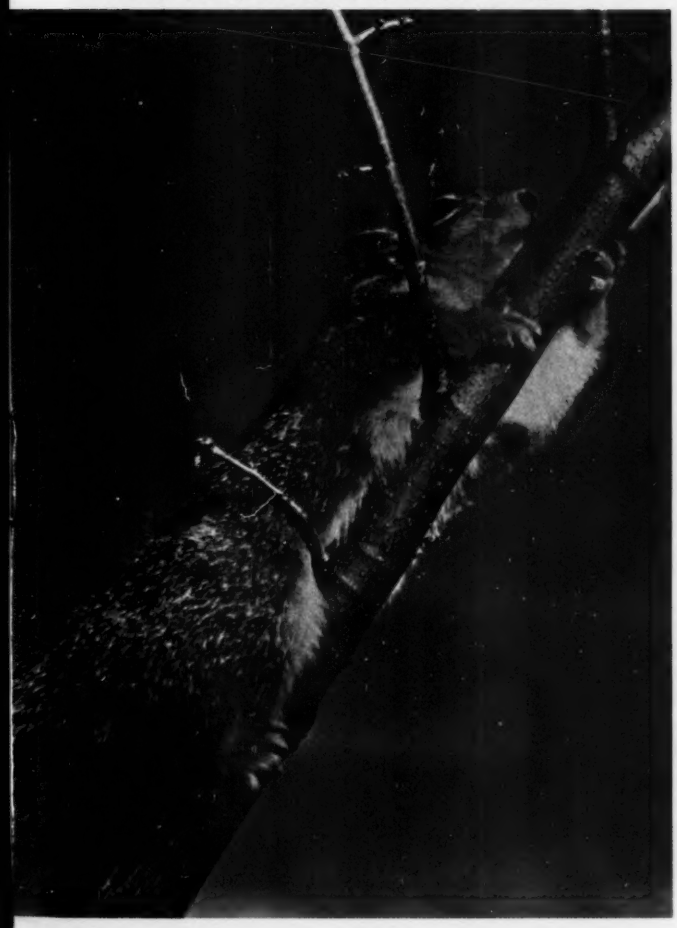
Now as you talk to your little Lewis and Clark—or is it Louise and Clarissa—go home again. That biggest, reddest barn in the county, where you swung 100 feet above the hay? If the dingy little building still stands, it has shrunk unbelievably and the launching point is a scant 10 feet above the floor.

Better store those golden memories away where the youngsters can't trick you into reexamining the originals. Try a new approach. On your vacation, your "Voyage of Discovery," show them what the country is like today and explain how they can make it an even better place tomorrow. And if ego gets in the way of judgment and you must tell them about the Golden Yesterdays, tell it like it was.

Teach conservation to your young explorers; it is a simple enough subject. Aldo Leopold, years ago, pro-

Truly an animal of the western plains. From the Journals of Lewis and Clark is this verbatim descriptive excerpt of a doe antelope: "She differs from Mail as to size being smaller with Small Horns, stright with a Small Prong without any beard, they are all Keenly made."

Generally associated quite closely with the Midwest hardwood forests, these fox squirrels have extended their range to become established species at Corps lake projects. Forestation programs have played a part in increasing the habitable range.



vided the only definition that captures the entire field of resources management when he said, "Conservation is a state of harmony between men and land." Plain enough, but he goes beyond.

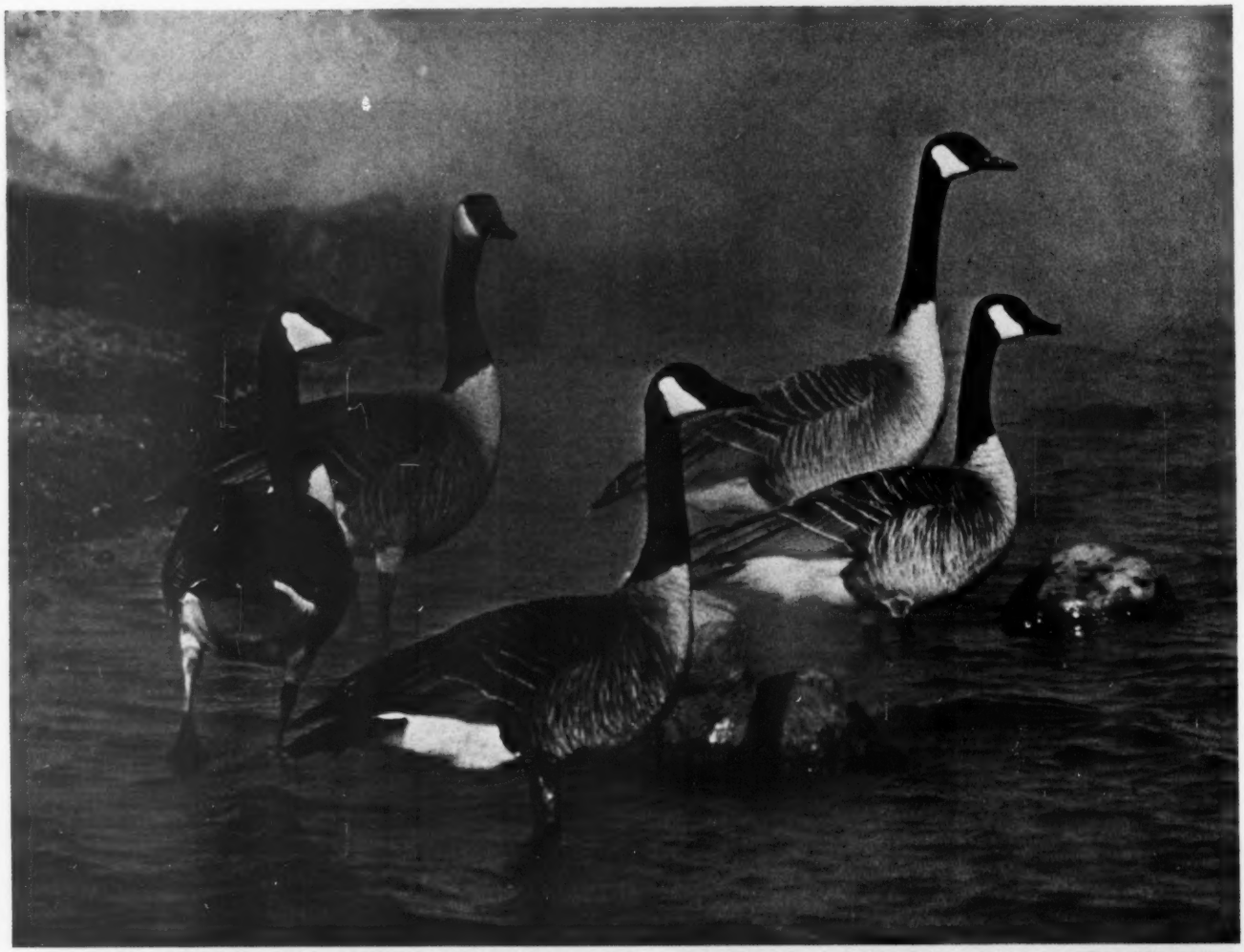
Leopold tells us that land means all things on, over or in the earth. Harmony with the land is like harmony with a friend—you cannot cherish his right hand and chop off his left. Or, for our neophyte explorers—you cannot love game and hate predators; you cannot build a forest and mine the farm. The land is one organism. Its parts, like our own bodily parts, compete with each other and cooperate with each other. The competitors are as much a part of the inner workings as the cooperators. "You can regulate them—cautiously—but you cannot abolish them," according to Leopold.

An exceptional opportunity awaits you at the public lands and waters administered by the Missouri River Division. Bring your young explorers to these lake projects and let them see for themselves the proof of Leopold's definition of conservation.

The 6 main-stem lakes have 6,000 miles of shoreline, and the land and water area encompassed by these lake projects totals more than 1.8 million acres. The lands and waters of 24 additional operating lake projects on the Missouri's tributaries bring the total amount of public lands and waters within the Missouri River Division to more than 2.25 million acres.

These lands and waters provide the modern day adventurer with quality recreation, and an increasing number of vacationing Americans flock to these inviting projects as the sources of clean air, pure water and open space. They are rediscovering what Lewis and Clark told us long ago in their Journal: "The air is pure and helthy (sic) so far as we can judge."

These Corps projects are proof of the natural resources manager's philosophy that building a dam creates more than a lake. That is simply the most obvious result, but the Corps is dedicated to enhancing the at-



Opposite-The melodious call of the majestic Canada goose rings out among this gaggle wading in the water of the basin.

Bottom left-Formerly a resident of the timbered bottom lands, the white-tailed deer has adapted well to its move from the banks of the river to the shores of Corps lake projects.

tributes and mitigating the shortcomings of the projects. Now you can teach your young adventurers to accommodate with Nature on your visit to the Corps' lakes.

Tell them about the more than 100 animals, by official count, that are threatened with extinction. Some of the endangered or threatened species you might see on Missouri River Division lake projects, if you and your expedition have patience, are:

Black-footed ferret, Indiana bat, prairie falcon, peregrine falcon, whooping crane, northern greater prairie chicken, lesser prairie chicken, burrowing owl, giant Canada goose, osprey, sharp-shinned hawk, pigeon hawk, ferruginous hawk, bald eagle, mountain plover, long-billed curlew, swift fox and the paddlefish.

To preserve these endangered species, a major national effort has been mounted involving many State and Federal agencies plus local and private organizations. Much needs to be done to manage and protect habitat, understand food chains and identify specific requirements of various species. You can do your part by educating your youngsters to the problem.

Teach them the importance of the natural resources management program in effect on Corps projects. It is devoted to saving endangered species and also to implementing appropriate management actions designed to save other rare or threatened species from the ignominy of making the Endangered Species List. Thomas L. Kimball, Executive Vice President of the National Wildlife Federation, in commenting on 1974's Wildlife Week, said, "Much of our wildlife is in good shape, but too many are in real danger. An endangered species does not have to become an extinct one."

Explain to your young Lewis and Clark that they probably will not see a black-footed ferret, a whooping crane, a wolf or a giant Canada goose, but it is important to each one of us to know that there are places where these creatures are helped in their struggle against extinction. Corps of Engineers projects are such places, and extensive areas within them are devoted to wildlife use. Specific actions taken within the Missouri River Division to enhance and propagate endangered species include:

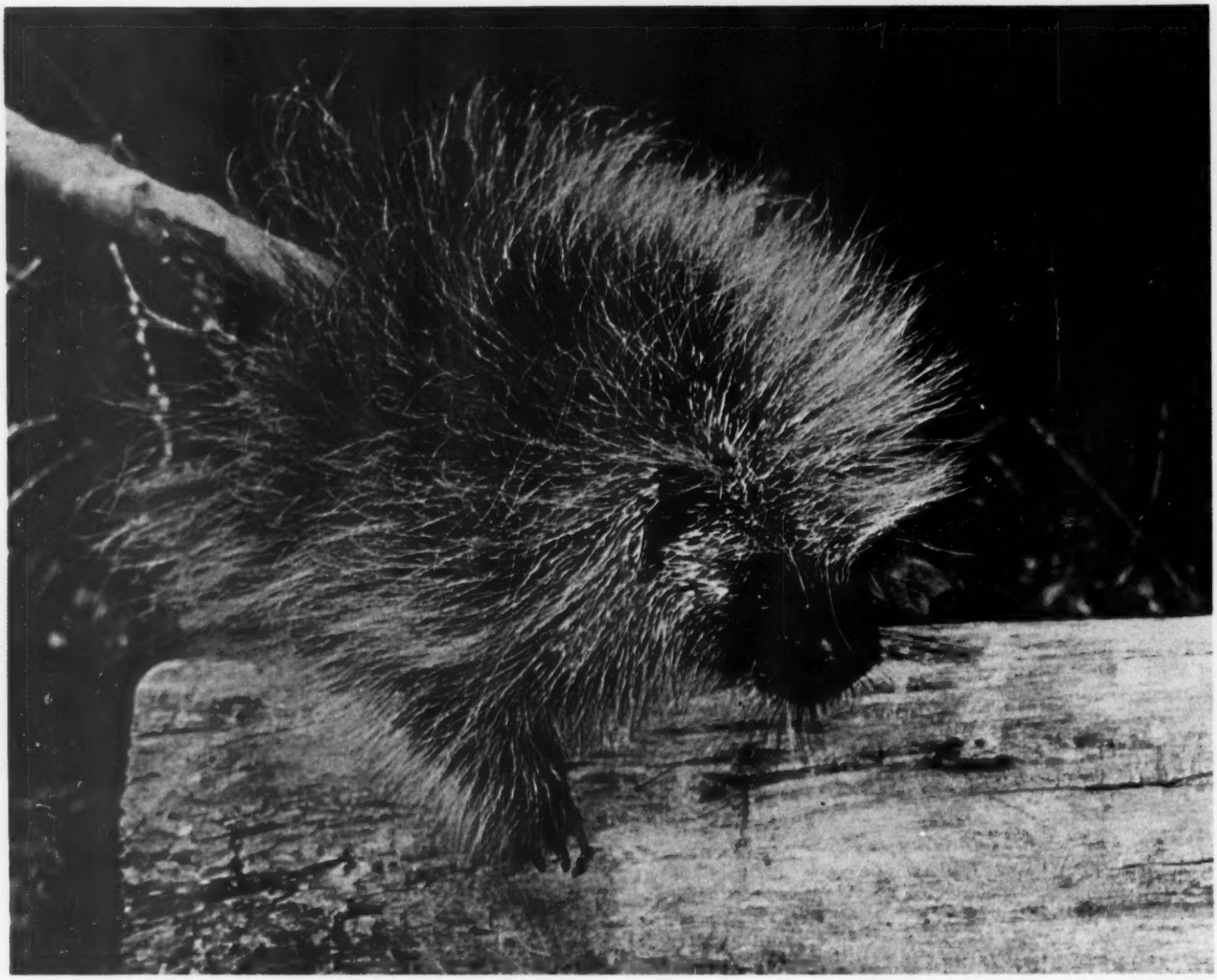
- Preservation of prairie dog towns. These little animals are a vital part of the food chain for the black-footed ferret.
- Initiation of a research study on paddlefish at the Harry S. Truman Lake project in Missouri.
- Establishment of a 300-acre eagle sanctuary below Fort Randall in South Dakota. The area, an important stop in the annual migratory flight, is a Registered National Landmark because of cooperative efforts of the Corps, the U.S. Bureau of Sport Fisheries and Wildlife, and private landowners.
- Development of a program to reestablish the big Canada goose *Branta maximus*. This program is underway at the Audubon Range on Lake Sakakawea in North Dakota and the Charles M. Russell Wildlife Range on Fort Peck Lake in Montana. This is a cooperative effort of the Corps and the Bureau of Sport Fisheries and Wildlife.
- Creation of nesting areas. Fort Randall Lake project personnel in South Dakota cut ledges in the chalk bluffs below the dam to encourage prairie and peregrine falcons to nest.

Introduce your young travelers to the visitor interpretative programs at Corps of Engineers lake projects. Here they can learn of the objectives of the Corps' natural resources management programs.

Introduce them to the things that are being done and why they are important. Show them where the Corps is developing vegetative plantings. Explain that in the

The intelligent and adaptable raccoon has learned to live quite well with civilization. Indeed he is a common, somewhat disruptive, visitor to established campgrounds.

The Missouri River Basin includes a large percentage of the most important duck-producing habitat in the United States. Great numbers and wide variety of waterfowl migrate through the basin which lies within two great migrational paths, the Central and Mississippi flyways.



Because of this fellow's tree damaging feeding habits, he is generally not considered a welcomed guest to a forestation program.

Great Plains these are especially important because of the severity of the seasons. If wildlife is to survive the rigorous winters, vegetative cover is a must. This mitigative action, coupled with intensive game management practices, can increase game population on public lands.

Show your explorers the reasons behind the apparently random plantings. Explain that there is nothing random about the location of planted food patches, the modification of the food stacks, the increased number of wildlife travel lanes that have been incorporated, the provision of added nesting cover, the calculated mowing activities and the strict regulation of vehicular traffic.

And explain about the flyways. Missouri River Division country includes both the Central and Mississippi flyways. The Missouri River is recognized as one of the Nation's most important waterfowl-migration routes since inception of flyway management in 1948.

At that time, flyway boundaries within the continental United States were established along State lines for ease in administering the four flyway units (Atlantic, Mississippi, Central and Pacific).

Since 1948, logic has dictated changes in these boundaries. And the Missouri itself has changed since inception of flyway regulation. A major upstream segment of the Missouri has developed from a meandering, turbulent river to a series of large lakes, and this has affected the original concept. So, your youngsters will soon realize that the flyways are as intricate as any complicated routes developed by man for his airlines or railroads.

Today when you tell them about "Where the Wild Goose Goes," you must explain that the *when* and *where* have become especially significant to Federal and State wildlife managers. The result is a new sophistication and precision in waterfowl management practices. The emphasis today is on management by population rather than species management.

For example, at least eight major populations of geese are recognized as using the Central flyway. So managing waterfowl populations is a complex task.

Progress is slow and sometimes frustrating, but success

The ring-necked pheasant is an important game bird in all of the Missouri River Basin States. The diversified habitat and land management actions on Corps lake project areas have been strikingly successful in helping maintain population levels.

is coming. The gradual renaissance can be seen.

The wildlife management biologist, in effect, works the way a farmer or rancher operates to raise feed crops or cattle. Objectives of the two differ, but they use similar management concepts. The farmer fertilizes crops to increase his yield—and his profit. The biologist manipulates habitat types to increase wildlife production. As the rancher puts up hay and silage to feed his herd during the brutal winters of the Great Plains, the biologist provides food and winter cover for wildlife on Corps lake projects.

Lewis and Clark marveled at the abundant fishing and hunting opportunities throughout the basin—and you will, too. Obviously the fish and game are not present in the abundance that the two young Army captains noted; nevertheless, all but the most avaricious will be delighted with the opportunities available.

Providing for the outdoor sportsman is still a major concern of the Corps' management program. But you and your small expedition represent part of an increasing number of persons broadly interested in our natural resources and outdoor recreation.

Of course nature lovers profit from established game management programs, but this is only part of the story. A well-rounded program of wildlife conservation must provide for the maximum variety of outdoor possibilities that are compatible with sound resources management practices.

Even if your young explorers are not interested in hunting or fishing, make them aware of the importance of hunters and fishermen. It was these sportsmen who supported Federal and State fish and wildlife management programs which benefit the nonhunter and nonfisherman.

You have described the programs for preserving game birds and game fish to your little expedition. But other species benefit from the programs as well. Several Missouri River Division lakes occupy a unique position within the transitional zone between the eastern hardwood forests and the prairie-mountain region to the west. If nature study is your thing, you had better

A 300-acre eagle sanctuary is below the Fort Randall Dam in South Dakota. This Registered National Landmark was established through the cooperative efforts of the Corps, the Bureau of Sport Fisheries and Wildlife and private landowners.

prepare your group to recognize both eastern and western songbird varieties. They may find them living together out here.

Prepare them to see the long-legged waders, common residents in the marshy regions of the lakes, including such graceful birds as the least bittern, the great blue heron or the Sandhills crane. Have those alert young explorers watch for the avocet with his upturned bill, the upland plover, the killdeer and the greater and lesser yellow legs. These are a few of the spectacular creatures hunting for food along the lakeshore and adjacent prairie land.

A wide variety of hawks will wheel and soar high over your caravan. Turkey vultures and ospreys may also soar over your camp or perch high on overhanging cliffs to study you. Noisy gulls and terns will lecture you about invading their domain. However, when their raucous comments get to you, listen for the many varieties of songbirds in the region or tune to the boisterous crows, jays and magpies common to most of the lakes.

Your own noisy young companions, exploring the cedar-lined coulees, may flush a great horned owl or a small brown burrowing owl. This little fellow may be occupying the deserted holes of skunks, badgers or prairie dogs.

Have them watch for a grebe; this mixed-up character dives like an Olympic champ, but he could do with more flying lessons. Or show them cormorants nesting in the inundated stands of dead timber. Let them study that master fisherman, the pelican, on his visits to the inland lakes.

Corps expansion into nongame management programs has begun, but much needs to be done. There is a place for marsh-life areas, natural areas, environmental study areas and programs involving people—interpretative and educational programs designed to make the latter-day Lewis and Clark a better neighbor for the furred, feathered and finned creatures of the Corps lakes. The programs are coming.

This is why the Corps of Engineers in the Missouri River Basin looks to you. Programs, no matter how detailed and well considered, depend on understanding by the people. With your help and with the understanding of the generations coming tomorrow, the Great Plains of the future will have as much to offer—both people and wildlife—as the Great Plains of today.

Teach your youngsters to explore, appreciate and understand this vast basin. It has captured the hearts of explorers since the "Voyage of Discovery" 170 years ago. With the wisdom and help of today's young, it will continue to captivate tomorrow's explorers.

On that day when your Lewis and Louise, Clark and Clarissa, have a touch of gray in their hair, they will know the thrill of a young Lewis and Clark saying, "Hey, there's a bald eagle" or "Look, Pop, a prairie chicken!" ■

Articles in previous issues of Water Spectrum discussed problems associated with land-use planning as perceived at the national and State levels. The following article shows how data and technology available through the U.S. Department of Agriculture can assist in satisfying the urgent requirement for better planning of both agricultural and urban activities within individual watersheds.

Matching resources and people

by Norman A. Berg

In almost every State, land use is a prime subject for discussion, argument and proposals for legislation. In one way or another, some 10,000 units of government are engaged in land-use planning and regulation. But for much of the Nation's land, especially in rural areas, there are no restrictions at all. Rural areas spend only a third as much as urban areas per person for land-use action.

While many communities are not ready to make intelligent decisions about changing land-use patterns, the pressure for change is there or on the way. Conflicting demands for natural resources are placing severe strains on economic, social, and political institutions; on the political process; and on the environment. These strains touch many interest groups and organizations as well as government units.

All this in a Nation that has 2.3 billion acres of land and water resources, beautiful countryside, and a favorable and varied climate. What's the problem?

The tremendous capability of American agriculture to produce food and fiber—record crops last year despite some tough problems—has freed Americans to take up 30,000 other vocations. In no other country do so many people eat so well from on-the-land efforts of so small a part of its population; the number of farms has decreased steadily since the mid-1930s.

But a society with 30,000 different occupations has many different outlooks or interests in how natural resources ought to be used and managed. People have different desires and different needs. A consensus is increasingly difficult to achieve. The migrations to pursue different occupations and lifestyles have produced fast-changing demands on the use of land, changes in the demand for community services, and changes in the ability of a community to support those services.

Norman A. Berg is Associate Administrator, Soil Conservation Service, U.S. Department of Agriculture.

Demands on Rural Land

The great increase in leisure time in America has multiplied the demand for land for recreation purposes. The most popular national parks have the congestion, pollution, crime and other problems of a city. Private land is increasingly being called upon to help fill the demand for recreation.

That's an opportunity for a new source of income for rural landowners, and it's an excellent chance to make multiple use of natural resources. But Americans in most cases haven't been willing to pay the full cost of providing the recreation service. In many cases they haven't been good stewards of the property.

A related demand has been the continuing increase in land purchase in rural areas by people from the city desiring second homes. The number of second homes started in 1971 was almost five times the yearly average of the 1940s, and second-home starts may reach 150,000 per year by the end of this decade.

At least six recreational lots are being sold for each second home started, indicating many people are buying for investment rather than building. They may never visit their property, much less take good care of it. Absentee ownership of rural land is a growing problem.

America's agricultural productivity permits a small percentage of the population to feed the whole country.

Other rural land-use problems are related to the increased concern for environmental improvement. People are more aware that poor land-use practices damage air and water quality as well as harming the productivity of the land.

The U.S. Department of Agriculture (USDA), working through soil and water conservation districts that are local units of State government, is helping landowners lessen problems of soil erosion, sedimentation, animal waste management, fire and others on hundreds of millions of acres. Yet millions of acres that are too steep and erosive are still being cultivated. Some land is still farmed where frequent drought or wet conditions present a high risk of crop failure and land damage. Some forest land and grassland is burned every year. Animal waste from farm feedlots is a growing water pollution hazard.

The public no longer accepts these practices and pollutants as a normal part of farming. Several States have decided that voluntary conservation action is not enough. In Iowa, for example, a landowner can be stopped from exceeding the soil-loss limits set by his soil conservation district. Every State will soon be subject to standards for nonpoint-source pollution that are being developed by the Environmental Protection Agency in cooperation with USDA and other agencies.

At the City's Edge

Land-use issues become far more intense in the fringe areas around major cities and in heavily populated States. People with differing ideas on land use occupy adjoining lots—or the same one. Pressure for zoning exceptions is heavy. And thoughtless, unplanned, uncontrolled land practices in urbanizing areas have created visible and extensive damage to the landscape.

The primary demand in the urban fringe has been for places to live and shop. Housing subdivisions have grown up everywhere. In New Jersey, for example, the number of housing units went up 20 percent in the 1960s, and it wasn't enough. All over America, subdivisions and shopping centers and community services have spread out across adjacent counties, often leapfrogging over agricultural land and creating helter-skelter communities difficult to service.

Too often, decisions about land were made regarding it not as a variable, damageable resource but as a standard commodity to be traded at will. Too often, growth has happened before communities had figured out what natural resources they had and how they wanted them managed and used. The result has been significant loss of natural resources, many of them irretrievable.

For example, between 1954 and 1964 Long Island in New York lost 29 percent of its coastal wetlands. Wetlands mean different things to different people. Some see them as areas to be bought at a low price and filled in or drained to make profitable land for development. Others see them as vital for fish and shellfish spawning, for recycling of secondary wastes, for flood control, for natural beauty. One group at Louisiana State University has calculated that marshland along the Gulf and South Atlantic shores is worth an estimated $83,000 an acre.

Future of Prime Farmland

Another resource lost has been a substantial amount of productive agricultural land. The same characteristics that make it choice for farming—level, well drained, with few soil problems—also make good farmland highly desirable for urban uses because construction costs are lower.

Land-use planning has been part of agriculture for many years.

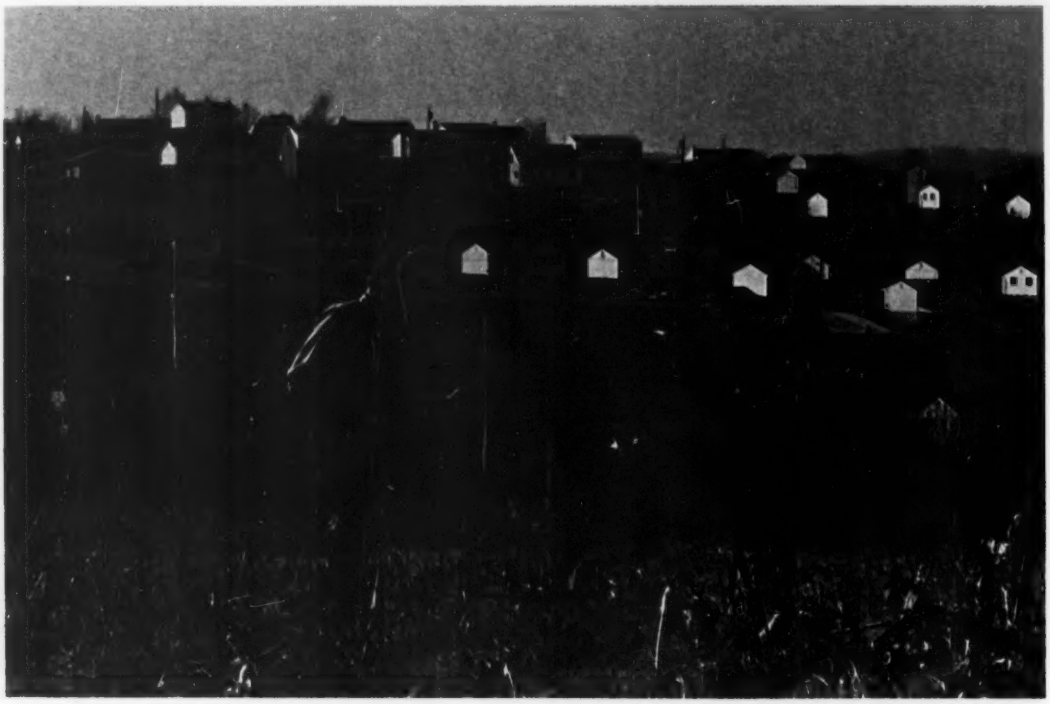
Farming can get squeezed out unless steps are taken to keep it in the urban fringe.

Should the best land be reserved for agriculture and houses be put on the less desirable land, thus increasing the costs of housing with no penalty to the farmer? Or should the demand for housing take precedence and farmers try to maintain crop quality and yields on poorer land (that may have conservation hazards as well as being more difficult to work with farm machinery)—with no penalty to the homebuyer except perhaps higher prices for hard tomatoes? Communities need to make the choice while there is time.

How much prime agricultural land do we need? Nationwide, there still is plenty of good land. So far, increasing crop yields per acre have kept pace with the conversion of up to a million acres a year to urban uses. But some crops—oranges, grapes, avocados, cranberries, for example—require specific soil and climatic conditions that can't readily be duplicated elsewhere. Once those acres are gone, they're gone. Further, some of the prime agricultural land is in small scattered parcels not economical for farming. As the best farmland is turned to other uses, it stimulates the cultivation of other land of lesser quality. The result is lower production, poorer quality crops, and higher soil erosion and sedimentation, followed by lower air and water quality.

New imagery from satellites holds promise in aiding land-use decisions.

In Allegheny County, Pa., soils data and a conservation plan are needed before building is done.

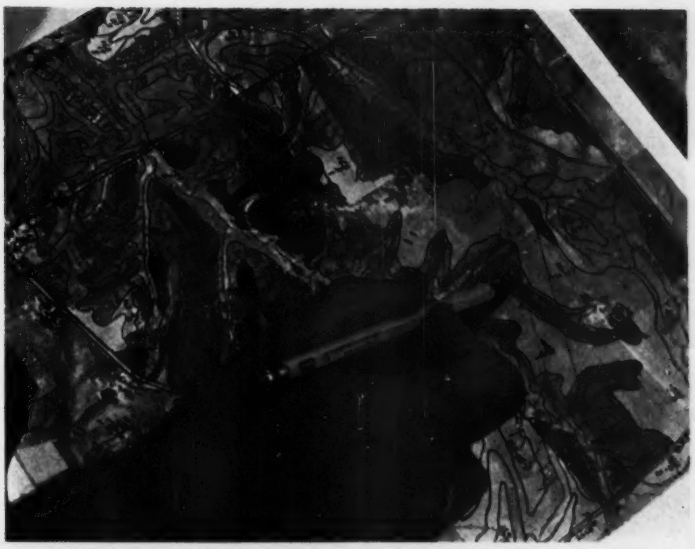


As land use changes around farmers, land costs go higher, labor costs increase, property taxes creep upward. Many farmers have been forced or enticed to sell out and move on. These are social and economic impacts of arbitrary land-use decisions. There are serious environmental impacts of the same changes:

- Tearing up large tracts of land at a time and leaving them exposed to wind and rainstorms for long periods has sped up the process of soil erosion and greatly increased sedimentation rates.
- Paving a large percentage of the land without considering the likely changes in stormwater runoff and ground-water levels has increased flood damages and ruined thousands of miles of streambanks.

Many States are developing laws and programs to deal with sediment and stormwater management problems from urban construction and other sources. In these States (and others), soil and water conservation districts—and through them USDA's Soil Conservation Service (SCS)—are assisting in the review of developers' plans.

In Pennsylvania, for example, a new State law requires



Facts about critical sediment sources are important in land-use decisions in the Iowa City area.

Land use can change quickly around a watershed lake; communities need to keep this in mind.

builders with tracts of 25 acres or more to make an erosion-control plan based on soils information before they move a spadeful of earth.

This is a procedure that millions of farmers and ranchers have followed voluntarily for a long time—obtaining soils and other natural-resource information about their property, exploring several alternatives for using the land, then planning the steps needed to protect the land in whatever uses are chosen.

The planning procedure, some of the conservation practices and the resource data are as useful in making a community grow as in making a farm go.

Data Base for Decisions

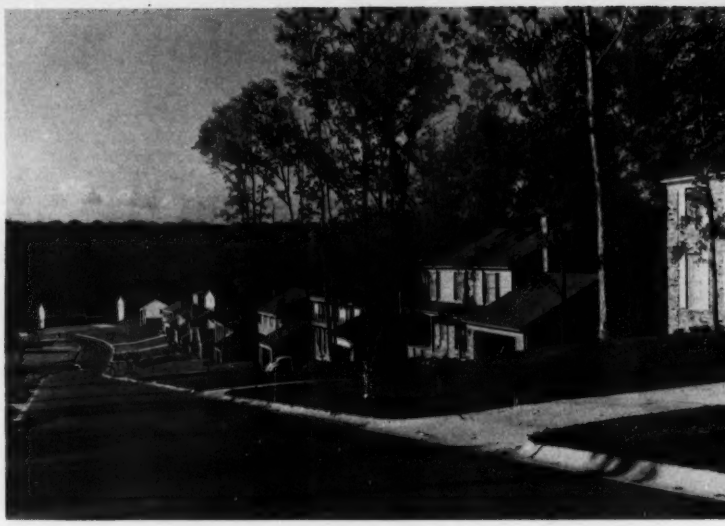
The U.S. Department of Agriculture is a source of many kinds of resource facts helpful in the land-use field. We also have considerable experience in interpreting the data and helping land-use decisionmakers understand and use the information.

Soil survey data, which we have compiled in cooperation with other Federal and State agencies, are now available in some form for over half the Nation, and for nearly three-fourths of the areas where housing and

Right-Cities spread across the landscape, too often helter-skelter.

Lower right-New housing can fit the landscape.

Below-Electronic data about winter snowpack can aid summertime decisions about land and water use.



industry are rapidly expanding. We also inventory soil and water conservation needs, analyze flood hazards, study recreation potential on private land, and survey winter snowpack for forecasting summer water supplies.

Shelby County, Alabama, is one of the places drawing on USDA experience and data. The county expects its population to double in the next 20 years as people spill over from neighboring Birmingham. County officials plan to restrict development of land for housing and other needs on the basis of slope, water table, hard rock, and flood frequency. Responsible builders in the area are saving large trees, sodding the exposed land quickly, and adapting other conservation practices to make the shift to urban land use a smooth one. In Birmingham itself, we helped develop an "outdoor classroom" at the new Huffman High School that is used by nearly every department in the school to relate textbooks to the natural world.

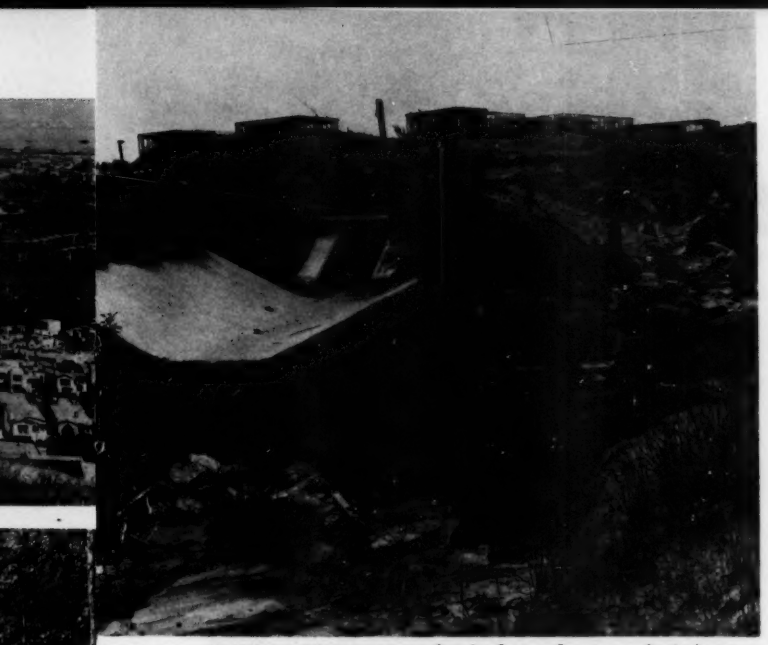
Iowa City, Iowa's regional planning commission uses our soils information as an aid in making land-use decisions—where to put a new sanitary landfill; locating critical sources of sediment; planning comprehensive sewer systems.

We also help local groups look at flood prevention and other needs in small watersheds. The more than 1,000 projects that have been approved for installation under Public Law 566 (Watershed Protection and Flood Prevention Act of 1954) cover nearly 70 million acres. Land treatment and structural measures that are in place have significantly lowered upstream flood damages and improved the environment. The local groups, learning to work together on these projects, often join forces on other community aims—such as land-use policies. Watershed improvements themselves have an effect on land-use patterns in the community.

The Mud River watershed project in Kentucky, for example, brought a dependable municipal water supply to Russellville and Lewisburg for the first time. The water brought new businesses that created 1,300 new jobs in a 7-year span. The Boy Scouts of America built a 1,100-acre camp at 1 of the 23 watershed lakes, and land values went up throughout the watershed. Kentucky's Spindletop Research, Inc., credited the watershed project with returning more than $20 in community development benefits for every $1 the project cost.

In large river basin studies we also work with other agencies to provide useful facts in identifying resource conditions and needs and in deciding on ways to improve resources for people.

Also, in about 150 Resource Conservation and Development projects, we provide resource data and technical and financial assistance. These projects are multicounty



Building without concern for the force of water and wind can damage the site and harm water quality.

efforts at environmental, social, and economic improvements, sponsored by local groups and government units. In States with regional planning groups, these projects generally have similar boundaries and can provide valuable natural resource data for regional decisionmaking.

Another major USDA involvement of long standing in the land-use field is our management of more than 180 million acres of national forests and national grasslands. The patterns of use of these lands and the private lands intermingled with them have an effect on each other.

In the Rural Development Act of 1972, we received authority to intensify our fact-gathering in land inventorying and monitoring. The Congress asked USDA to report every 5 years on the state of the Nation's resources and to survey and monitor soil and water resources, prime agricultural lands, and flood plains.

We are cooperating with sister agencies in several departments to decide what kinds of data are needed, define carefully some of the resources being studied—such as prime farmland, and set up monitoring procedures. This builds on the SCS experience with conservation-needs studies of the 1950s and 1960s.

With so many activities aiding land use or impacting on land-use patterns, the Secretary of Agriculture decided last year to set up a Committee on Planning and Policy for Land Use and Land Conservation, with members from the eight USDA agencies most involved with land use. They have helped stimulate interagency thinking on land use; they have readied the Department to give more effective help to States and local governments in setting land-use policies; they have kept an eye on State and national land-use legislation; and they have compiled a highly useful booklet *Land Use Planning Assistance Available Through the U.S. Department of Agriculture.*

Last October, the Secretary issued a statement defining land-use policy as "the expression of society's determination of how its resource, land, is used. Land-use policy refers to the total of all those national, state and local laws, ordinances, and attitudes affecting the short-term or long-term uses of land, private or public, through such mechanisms as ownership, inheritance, taxation, condemnation, zoning, redevelopment, building regulation, master planning, legislative fiat."

He outlined several actions USDA will take to improve each of the 80 or more Departmental programs influencing private and public land-use decisions and to make the programs dovetail better with each other.

Interchange of ideas will ensure that USDA people in every county in America will do a better job of helping get information to those who need it when they need it in a form that meets their needs. USDA people are also available to help community groups and government leaders get together to discuss some basic questions about their aims for the future of the community.

Land-Use Dialogue

Public participation in setting land-use policies and making land-use decisions will be just as important a part of any land-use process as the natural resource inputs, recreation needs, population density and trends, economic factors and other data. People will not support plans they don't understand and had no hand in formulating.

A land-use process will also need to be able to blend Federal programs, such as Farmers Home Administration water and sewer loans, with State and local objectives. Interchange of ideas and data among agencies of all kinds will be vital—for example, we have useful new imagery from the Earth Resources Technology Satellite (ERTS) that takes electronic readings of the American landscape in 110-mile-wide strips. SCS has compiled four mosaics of the United States from the imagery. These maps provide planners and others with an unparalleled overview of the physical features and natural resources of the Nation. They represent the first view of this country not obscured by clouds and distortions.

All kinds of data are now available or being worked on to aid in land-use decisions. Agencies are cooperating more closely than ever before to improve the "technology base." Facts must be combined with the ideas and aspirations of local citizens to guide land use in a way that will work. Governments, particularly in rural areas, simply must become more involved in land-use questions. The individual landowner cannot always cope with the land-use urgencies closing in on his ownership boundaries. In the long run, decisions he makes in isolation may be neither good for him personally nor good for the community or the Nation.

Land use is part and parcel of practically every development effort in America. Until we have dealt with one we will not fully succeed in dealing with the others. We have not dealt with land use if we have simply planned. We need to get decisions made, plans implemented, land-use shifts made wisely and timely.

We have an obligation to help communities get the job done. ■

by D. P. Booth and R. T. Saucier, Ph.D

DREDGED MATERIAL DISPOSAL EFFECTS AND ALTERNATIVES

dredging to create and maintain navigable channels for our Nation's waterborne commerce—a basic activity and responsibility of the Corps—inherently requires removal of large quantities of sediment, which must be disposed of economically but with the least possible adverse environmental impact. But just what are the impacts or effects, and what are the alternatives?

Localized studies have been made to investigate the environmental impact of specific disposal practices and to explore alternative disposal methods; however, these have not provided sufficient definitive information for general application or predictive capabilities. Therefore, a research program of national scope is underway at the Corps' Waterways Experiment Station (WES) to seek answers to basic and critical questions.

The answers will come from the combined field and laboratory investigations being conducted at WES within our Office of Dredged Material Research (ODMR). The objective of our Dredged Material Research Program (DMRP) is to develop technically satisfactory, environmentally compatible and economically feasible alternatives for dredging and disposal. This includes considering the dredged material itself as a manageable resource; dredged material had once been regarded as a nuisance waste product to be dumped in our open waters or on our marshes without any awareness of the environmental consequences.

Lack of knowledge about these consequences has caused us, as a Nation, to use interim measures in an effort to reduce or prevent degradation of water quality. These measures include confining dredged material within dikes and attempting to analyze the sediments themselves for traces of pollution. Since the effect of dredging on water quality has been acknowledged as an unknown more than a reality, Congress accepted the need for fundamental and applied research to provide permanent solutions.

Congress authorized such research in Section 123(i) of the River and Harbor Act of 1970, and eventually WES was assigned the challenge. In February 1973 (after a year and 8 months of problem identification and assessment and research program development), the Office of Management and Budget approved a 5-year, $30 million program with the understanding that any research efforts would be cut off if they did not give immediate promise of effective results for the Nation.

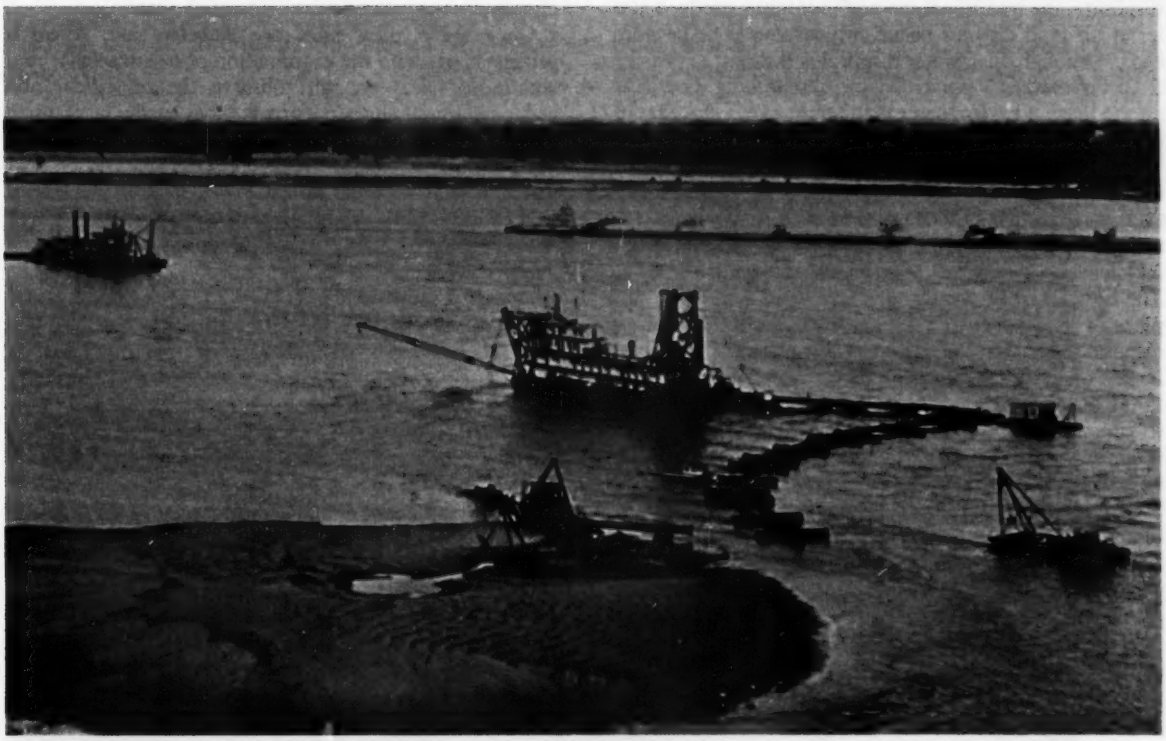
The Four Projects

Our first annual report, published March 1974, illustrates our initial accomplishments in defining the problems and outlining the goals we had established for each of our seven areas of research. Since then we have consolidated our program goals and tasks into four areas directed by project managers responsible for:

- Aquatic Disposal
- Habitat Development
- Disposal Operations
- Productive Uses

This structure makes it easier to manage and coordinate the entire program while disseminating the results of each project to our own Corps districts and other agencies without having to wait for the entire research program to be completed. Thus, immediate benefits from the ongoing research may be used in assessing the environmental impacts of disposal operations and also in

Both authors have worked in the Dredged Material Research Program at the Waterways Experiment Station, Vicksburg, Miss. She is Technical Writer in the Environmental Effects Laboratory and he is Special Assistant, Dredged Material Research Program, Environmental Effects Laboratory.



Millions of cubic yards of sediment must be dredged annually to maintain navigation channel depths because of the effects of shoaling.

Decisions regarding the best method of disposal will depend on results of Corps research into the nature of dredged material and its potential for pollution.

planning and implementing future dredging and disposal projects.

Aquatic Disposal

Largest of the four research projects is concerned with aquatic disposal. Research undertaken within this project involves multiple aspects of the effects of open water disposal—the traditional method (confining dredged material on land did not begin until a couple of decades ago). Although open water disposal is the least expensive from the dredger's point of view, researching its effects on the marine environment is the most expensive part of our program.

In years past all dredged material was considered the waste byproduct of a dredging operation. The dredging itself was the major concern because it accomplished a recognized good—the initial development and continued maintenance required of a channel used for navigation. The upswell of environmental awareness that has taken place in recent years focused attention on this method of disposal. After all, dredged material constitutes the largest quantity of matter placed or redistributed by man in the marine environment. Although long-term damage to ecosystems has been documented in only a few instances, the fear of adverse consequences has forced us to expend tens of millions of dollars for the widespread precaution of putting dredged material on land and confining it.

The question we are attempting to answer is: Under what conditions will the magnitude of environmental impact of open water disposal be sufficiently adverse to warrant expenditure of significantly larger amounts of money for alternative disposal methods? A basic tradeoff is involved here.

Within this first project are five distinct tasks. The first is the most expensive and involves field research in open water disposal areas. This research should answer the question of how to characterize a disposal site over a period of time. Is it really a barren wasteland, as some would have us think? How fast do the flora and fauna recover after disposal? This task concentrates on studying individual, carefully selected sites currently being chosen from among several potential areas.

Once these pilot sites are selected, the research process starts with the examination of existing (baseline) conditions. Next we will observe the biological and water quality changes occurring from carefully planned experimental disposal operations. Finally, we will document everything that has been observed and evaluate the results of actually field testing the hypotheses developed in the laboratory.

A second task within this project is to determine the fate of dredged material in an open water environment. How does the material disperse? Where does it settle out? Where does the suspended part (the turbidity-causing particles) end up? The answers to these questions are important because the specific movement pattern of the material often determines the effect on the aquatic environment.

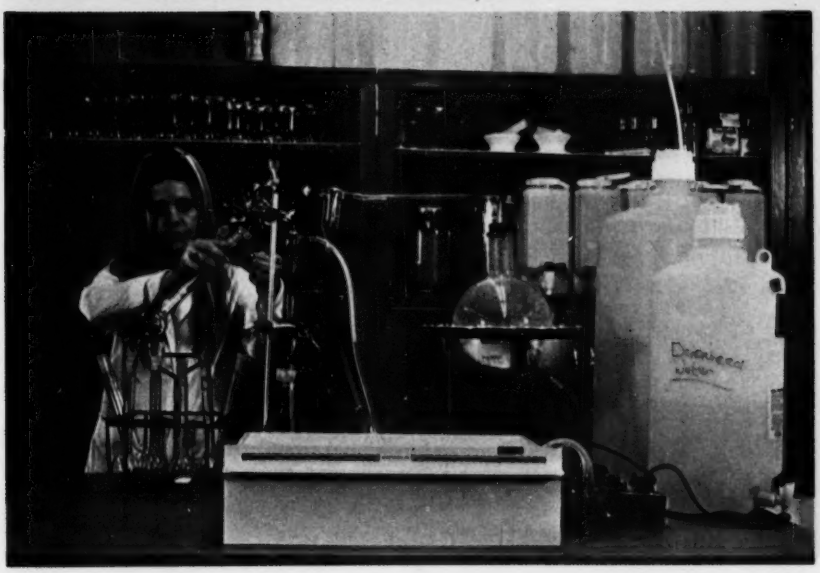
We are looking for a predictive capability in this part of our research. At present the only viable approach toward determining sediment movement appears to lie with the use of mathematical models that simulate conditions during the time span between the instant of release and the moment the dredged material settles on the bottom. Long-term models will be developed to represent not only the transit time between discharge and settling, but also the redistributing effect of tides, storms and circulation patterns.

We are also looking at understanding and quantifying

DREDGED MATERIAL RESEARCH PROGRAM			
Aquatic Disposal Research Project	**Habitat Development Research Project**	**Disposal Operations Research Project**	**Productive Uses Project**
Coastal Disposal Area Field Research	Upland and Marsh Disposal Environmental Impacts	Containment Area Operation Research	Aquatic Disposal Concepts Development
Movements of Dredged Material	Artificial Marsh and Island Creation	Dredged Material Densification	Upland Disposal Concepts Development
Effects of Dredging and Disposal on Water Quality	Habitat Development Research	Treatment of Contaminated Dredged Material	Land Improvement Research
Effects of Dredging and Disposal on Aquatic Organisms		Turbidity Prediction and Control	Products Research
Pollution Status of Dredged Material		Basic Equipment Related Studies	Disposal Area Land Use Concepts

the effects of disposal on water quality and aquatic organisms. In terms of water quality, we want to know the immediate physical and chemical changes taking place in the water. For the organisms living in that water we need to know the basic biological cause-effect relationships that develop. We will be studying sediment geochemistry to determine the manner in which contaminants such as heavy metals in the sediments become available to cause adverse effects in the aquatic environment.

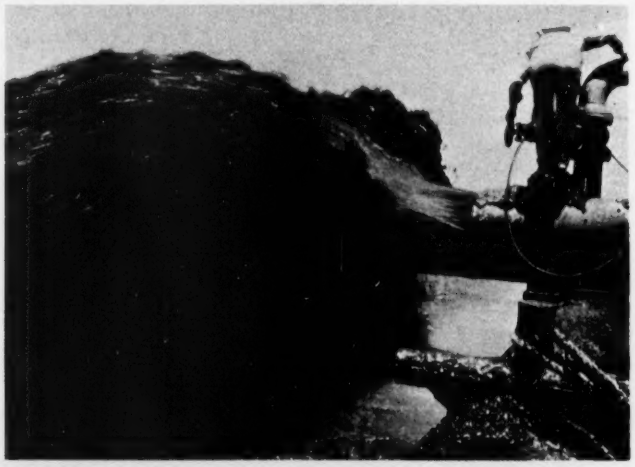
Heavy metals such as mercury, zinc and lead, along with such substances as pesticides, may have toxic effects on marine and freshwater life. Since we do not know how available such materials become in various chemical forms once they enter the marine environment, the investigations of their effects on water quality and aquatic organisms are beginning in the laboratory. Heavy metal contaminants may be tightly bound to the sediment particles physically or chemically or, at the other extreme, simply dissolved in the water mixed with the sediment.



Diked disposal areas are being evaluated to increase their effectiveness.

Laboratory examination is being used to determine presence of pollutants in dredged material and possible effect on water quality and aquatic organisms.

Predicting the patterns and rates of plant and animal succession after disposal takes place is one of the research tasks at WES.



Hydraulic dredges are awesomely efficient movers of material as they maintain harbors and waterways for the Nation's waterborne commerce.

Creating island sanctuaries for migratory waterfowl and endangered species need not conflict with protection of fisheries and water quality.

A separate task is attempting to define exactly what constitutes "polluted" sediment and its potential for causing problems within the environment when dredged. We are also concerned with developing the sampling and analysis techniques with which we hope to predict the probability of adverse effects and regulate operations accordingly.

Habitat Development

Our second project contains three separate tasks designed to enhance the use by wildlife of lands associated with disposal of dredged material. While disposal operations in uplands and marshes have fundamental similarities to disposal in open water, different questions are posed.

Before the enhancement or creation of habitats for wildlife can be attempted, we are exploring in the first task the many unknowns of the environmental impacts of land disposal. Upland and wetland environments are more diverse than those of open water, and since they are also man's habitat, there are socioeconomic factors to consider besides physical and biological ones. Aesthetics and land values must now enter our considerations, along with problems such as ground water contamination.

Part of this task will be to pinpoint beneficial and adverse aspects so that we can as fully as possible give monetary values to them. Then we can use a benefit-cost ratio on the monetary values. For nonmonetary values, we will have to isolate the factors involved and evaluate them qualitatively. The purpose is to put all factors into a usable form for decisionmaking.

The second task is concerned with creating artificial marshes and island habitats. Here we will be dealing with wetlands created by placing dredged material in a shallow body of water and thereby converting it into an intratidal (within the tidal zone) marsh. The problem in creating new wetlands is to establish optimum growing conditions for marsh-type plants best able to tolerate the physical and chemical regime imposed by constant wetting and drying.

That type of dredged material which is organic and nutrient rich is well suited to help nature shape new wetlands, which are being destroyed faster than both man and nature can fashion them. Aside from the aesthetics of such areas, wetlands serve as wildlife sanctuaries, produce commercial and sport fishing, dampen storm effects, and function as natural traps for safe containment of materials which would otherwise become pollutants.

The third task within this project is named habitat development. This task involves manipulation of the environment for the benefit of a desirable species or community rather than actual creation of a habitat. Here we will have to be site specific because we may attempt in one case to enhance a shallow underwater disposal site for marine grass growth while in another case promote an upland game habitat or even a nesting and resting site for birds. We will look toward optimizing a particular site for a specific type of lifestyle by controlling and changing such factors as elevation, size, or sediment type.

In developing an island habitat, we are concerned with controlling its fate as either an area of unvegetated, open sand flats or vegetated cover, depending on which indigenous species we wish to encourage. The species we attract will depend on how we regulate the pattern of colonization. We can control the sequence of plant succession in order to prolong a particular stage of growth for the benefit of a specific species.

Disposal Operations

This research project is subdivided into five tasks. The first, operation of confined land disposal sites, is producing immediate results for the Corps. We must optimize management of these sites for two reasons. First, the facilities must be effective in preventing the unregulated spread of the often syruplike slurry (approximately 20 percent solids) into surrounding areas. Second, they must reduce the amount of suspended material in the effluent or runoff by trapping the solids and allowing only the water in the slurry to run over the weir or sluice.

Many problems are inherent in confining dredged material:

- The integrity of dikes built on ground with poor foundations is difficult to maintain; yet the optimum containment sites are likely to exhibit the poorest soil qualities for this purpose.
- The dredged material stays fluid for extremely long periods unless treated or mechanically consolidated.
- Stagnant water in the slurry sometimes generates odors and encourages breeding of mosquitos.
- Containment areas that are too small or improperly designed permit the sediment to flow directly over the weir unless some physical means are present to slow down the flow.

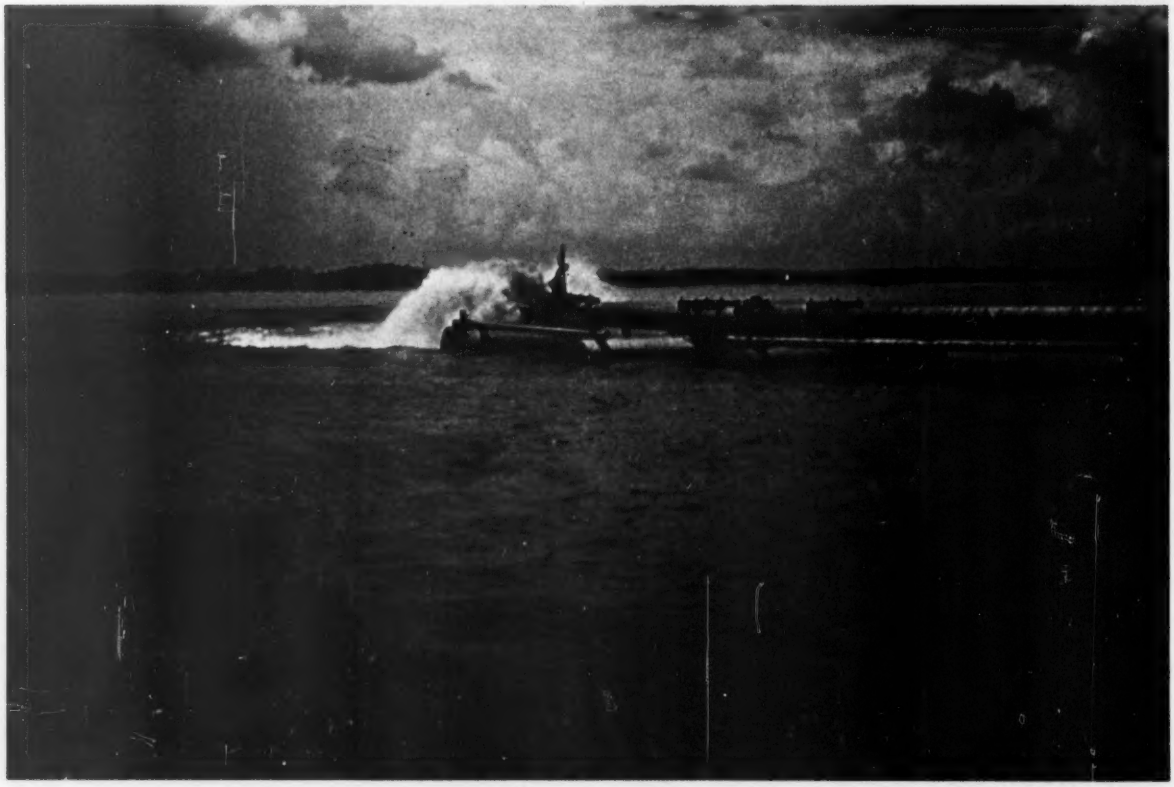
The second task under this project includes devising techniques to densify deposited sediments. The great bulk of dredged material consists of silty clays, which present a problem in drainage and consolidation. Crusts up to 5 to 6 inches thick form over several feet of dredged material causing retention of its high water content. Densification means getting the water out. This can increase substantially the life expectancy of a disposal site by reducing the volume of the underlying solids. Several methods have been tested, including running a tracked vehicle back and forth to break up the crust and increase the rate of evaporation. Another promising possibility being explored is to plant certain reeds and canes in these sediments to reduce water content through transpiration.

The third task relates to the traditional treatment of waste materials as practiced by sanitary engineers in handling municipal and industrial sewage. The basic difference is that current treatment plants are geared to fairly constant flows. Dredged material, however, arrives onsite sporadically and at an extraordinarily high loading rate. Therefore, current practices may or may not be amenable for treating dredged material contaminants; but we must find out, since treatment may be the most

Field inventories and surveys of both land and water disposal sites and examination of dredging operations are being conducted under all environmental conditions.

Dikes must be constructed around many sites to prevent uncontrolled spread of dredged material into adjacent waters and wetlands—the enclosed basins themselves present problems in environmental management.

Turbulence from dredging and disposal operations clouds adjacent waters with suspended particles of sediment that may or may not create adverse impacts on the environment.



practical solution to certain problems.

The fourth task is to predict the amount of turbidity caused by dredging and disposal operations and to seek methods of controlling it. While we do not fully understand the extent of the biological consequences of turbidity in open water—and it is possible that the biological consequences of turbidity caused by dredged material disposal have been grossly overrated—we cannot deny that situations occur where turbidity is biologically or aesthetically unacceptable, and some type of control is necessary. The goal of this task is to identify circumstances when regulating turbidity is desirable or necessary.

The last task in this project, completing the picture, is to look at the dredging operation itself to see if modifying dredging practices can help alleviate disposal problems. Use of accessory equipment in the dredging or disposal operation is also being evaluated.

Productive Uses

This project consists of five tasks associated with potentially productive uses of disposal sites and/or dredged material, such as reclaiming strip mined areas and providing waterfront land for recreational parks. We are considering, in other words, uses that may go on for decades and are relatively permanent. These uses are in addition to the wildlife habitats on artificial islands mentioned earlier under another project.

In some instances the fine-grained sediment in slurry form might be transported inland for landfill at abandoned pits and quarries or for use in the enhancement of agricultural lands. In other cases the dredged material may be used to control coastal erosion. Many locations, including strip mined areas, can be considered desirable disposal areas as well as be reclaimable land, since they are already in a degraded state.

Our task is to inventory and define the geographical extent of these potential disposal areas in relation to the locations where dredged material will normally be generated. Transportation to inland sites might be accomplished by pipeline or by hauling over railroads and highways. Unit trains of as many as 250 coal cars often return empty from shipping points to mining sites when they could possibly be filled with sediments and slurry suitable for landfill and reclamation use. This may sound like an oversimplified solution to a very complex technical and sociopolitical problem, but at least it illustrates the point.

The task we call land improvement is *material* oriented rather than site oriented and focuses on regions of the country where large sanitary landfills are required near the larger urban areas. The soil necessary to bury this landfill is not always available onsite in these regions and has to be trucked in at considerable expense. Perhaps sediment separated, drained, and stockpiled at disposal sites could be transported to these landfills as substitutes.

The value in such a practice lies in the public attitude toward dredged material as a waste product of dredging and the ever-increasing need for more valuable land for waste disposal. Since the dominant land use at sanitary landfills is disposal of wastes, we would merely be using "dredged waste" to cover municipal waste.

One of the associated problems we will have to deal with is the quality of the "leachate" or liquid runoff from such areas induced by precipitation.We do not know if the presence of dredged material in solid waste hurts or improves the ground water. We do know that clay soils and certain types of soil organisms tend to trap leachate pollutants under certain conditions.

As mentioned earlier, one of the most promising productive uses of dredged material is to provide landfill for water oriented recreation areas such as islands, peninsulas and shoreline parks. Although landfill composed of dredged material usually provides poor foundation conditions for many years, it *will* support uses such as ballfields, parking lots, parks, playgrounds, boat launching ramps, nature trails, overlooks and conservancies.

Managing the Program

A program such as this requires a steering group to guide it, good coordination and lots of communication. Guidance is provided by a Program Planning Group consisting of the chief, assistant chief, program manager, the four project managers and the two coordinators of the Office of Dredged Material Research and a consultant from WES Hydraulics Laboratory. This group is responsible for technical planning, coordination, and setting program priorities—and is backed up by Research Planning Groups functioning in each project.

The two full-time coordinators have been assigned to the ODMR for both internal coordination with Corps Districts and external coordination with other agencies. A separate group has been set up to increase the efficiency of our communications through the use of technical reports and dissemination of current information on each research task via a widely circulated monthly newsletter.

The coordinators and publications make our research efforts known as quickly and widely as possible to the Corps districts and other agencies. What we are looking forward to is an even wider dissemination, so that the Nation can more rapidly learn what dredged material consists of and its effects on the environment. ■

by Paul R. Edwards

A PUBLIC INVOLVEMENT STRATEGY

Since 1806 when explorers scaled the bluffs that "had a perfect command of the river" and from which Kansas City grew, Kansas Citians have had a fundamental relationship with water. The Missouri River gave birth to the city and provided a livelihood for its settlers, who prospered with the riverboat trade. More recently water has been basic to recreational and industrial development. Kansas Citians also have suffered from rampaging floods and have come to know the worth of protective measures.

Today, as the area experiences new surges of growth, the use and management of Kansas City's water assume even greater importance. Therefore, an extensive examination of water needs and requirements is underway. While it would seem that the city's historic

association with water would encourage citizens to become directly involved in determining the future use of this basic resource, this is not the case. A strategy had to be developed to bring out even limited public expression.

The strategy, in this instance, is part of a deliberate attempt by the Corps' Kansas City District to find the most practical ways to get a reflection of public attitudes for use in a 3-year urban study. The study is one which the U.S. Congress authorized the Corps to make in cooperation with the Mid-America Regional Council, the States of Missouri and Kansas, and other Federal agencies. It is scheduled for completion in late 1976 and is being conducted with the help of municipal and county governments, and several public and independent organizations.

Out of the 3-year basic investigation will come a 50-year plan for managing and protecting water resources in the eight counties comprising the Kansas City region. The study and subsequent plan, embracing public input, will be a basis for authorizing and applying public funds for management of the Kansas City region's water and related land resources.

The Corps contracted with our consulting firm to help develop a program to generate public awareness and bring about public participation. We have adapted some methods from other programs and originated some we feel are especially applicable to Kansas City. In all cases, the material we communicate is tailored to Kansas City's situation, emphasizing the importance of the urban study as a basis for determining the area's long-range water needs.

Our challenge is to:

- Create an awareness of the study and the opportunity for individuals to engage in the planning process;
- Overcome public reluctance to become involved;
- Inspire the citizens to express their desires;
- Assure that all views are represented; and
- Maintain the integrity of the public involvement program as a viable form of communication rather than tokenism.

To accomplish these things we emphasize to the public that water is the city's most valuable resource. We remind the public that most problems associated with water are regional in nature, encompassing the management and protection of water in eight counties of Missouri and Kansas. We point out that solutions must interrelate alternatives for water quality, quantity, use, control and conservation.

We seek a broad public expression of water-problem concerns and needs in order to set the stage for a continuing public response and contribution through all stages of the planning process. To do that we show how existing conditions relate to the day-to-day activities and needs of citizens, so that the public becomes more aware of matters most likely to be treated in the long-range plan.

Floods, for instance, are still a danger in the Kansas City area. Eighteen percent of our total metropolitan land lies in the flood plains. Although progress has been made toward more flood control measures since a devastating flood in 1951, every county in the region still has areas subject to flood hazards. Citizens thus need to express what is wanted or acceptable in the sound management of the flood plains.

Despite a plentiful supply of water from our two great rivers—the Missouri and the Kansas—some parts of the region may face a future water shortage. Even now many small communities and outlying water districts in the developing areas are finding it difficult to guarantee an uninterrupted water supply. This predicament is largely a matter of distribution, and the current study will address this major problem. Public participation will be particularly important in coming to grips with issues related to the institutional arrangements.

We also want the public's point of view regarding open space, lakes and streams, fishing and water-related recreational facilities of all kinds. The study will project the future need for these areas, propose some solutions to meet the demand, and explore ways to implement recreation and open space programs. We must also consider the controversial matter of providing facilities for pleasure boating in channels that also accommodate commercial traffic, and consequently a proper reading of the public's view on improving the rivers for both recreation and commercial uses is important for a viable long-range plan.

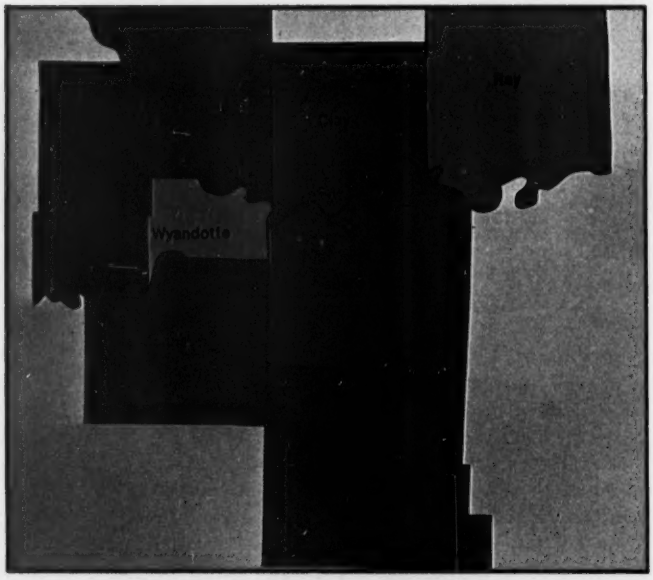
Another important consideration is the damage to our water from sewage, industrial wastes and other pollutants. Extensive efforts are already underway to solve some of these problems, but the urban study together with other studies needs to lead to an area-wide approach for managing wastewater. And public awareness and public participation are needed in formulating a management plan.

Residents throughout the Kansas City area will feel the impact of decisions made about one or more of the above matters, and that is why Wayne Leidwanger, the Corps district's community planner, insists every citizen must know that an opportunity exists to discuss problems and alternative solutions addressed by the urban study. In discussing guidelines for offering that opportunity, he has said, "It's not enough to merely meet administrative requirements for public meetings. We have an obligation to the public to go further than that. People who have such an important stake in how water management will affect their future should have a chance to help shape that future. Representatives of special interest groups *do* participate, and I think every citizen should know that he or she can exercise the choice of entering into the discussions as an individual. That's our obligation—to offer within the limits of our budget the option for meaningful citizen involvement in the planning process."

The budget for public involvement during the 3-year period is about $150,000, a little over 8 percent of the

Opposite-The Kansas City area's relationship with water dates back to the early traders and fur trappers who first settled the region. Later, the settlement grew to a city and became prosperous thanks to its association with the rivers.

Mr. Edwards is Principal of the Public Affairs Assistance firm in Kansas City.



The urban study in this eight-county Kansas City region is designed to examine conditions and alternatives for the area's water use over the next 50 years.

Below-The rapid growth and development of the metropolitan Kansas City area make an in-depth plan for its future water needs an immediate necessity.

total $1.8 million urban study. This may be higher than amounts that would normally be allocated; however, in a sense, this is an experimental endeavor in that we are trying a number of modes to make sure that the people of Kansas City have knowledge of the opportunity to participate in the urban study.

Involvement activities have been geared to varied interests, thereby generating a general public understanding of conditions and inviting an expression of views by those electing to present them.

In that context the Corps made a long-term commitment to an involvement program which would inform the public; and, in turn, be informed by the public—through determining its perceptions and, as the planning process proceeds, obtaining feedback on proposals.

For the Kansas City area the "public" is broadly defined to include all groups and individuals interested and potentially interested in the urban study, bringing together citizens, experts and decisionmakers. The definition of these three categories was adapted from an urban problem-solving process for transportation in Cleveland, Ohio.[1] In one category are the citizens, represented both individually and collectively through special interest organizations. A second category consists of experts in technical areas, including professional planners, engineers, and representatives of other disciplines. In the third category are the decisionmakers who establish parameters for the planning activity, select planning alternatives, and in many cases implement plans into action. (Among these are the government officials at all levels, important businessmen and others.)

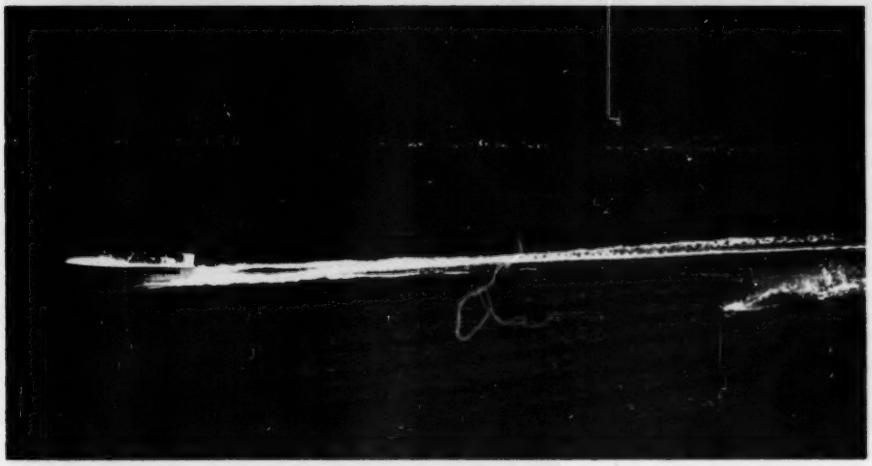
The District Engineer, Col. W.R. Needham, invited

1. James B. Reswick and Sherman K. Grinnell, "Toward an Integrative Process for Urban Problem Solving." 1970.

Flood hazards still exist on the smaller streams in the region because 18 percent of the Kansas City area is within the flood plain.

Center-Commercial traffic, like this barge, vies with pleasure traffic for use of the Missouri River. The urban study will examine ways to balance these demands.

Bottom-The ever-increasing demand for water-based recreation in the growing Kansas City area will be a prime factor in planning future water use and management for the area.

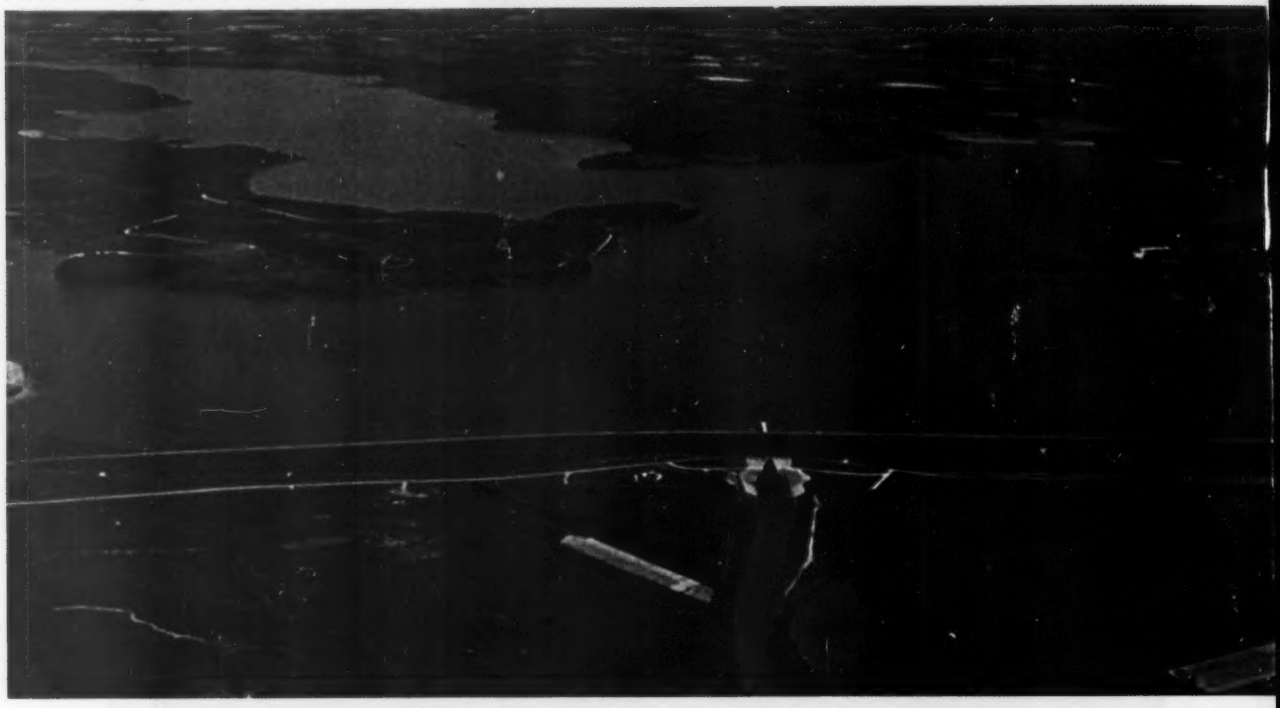


people from the 3 categories to serve on a Public Involvement Committee to help determine the adequacy of the involvement activities. The committee is limited to about 10 members to ensure that it would be a functional size and is scheduled to meet about every 6 months during the 3-year period. The committee has proved to be a source for suggestions on public involvement activities. It monitors and audits the legitimacy of the involvement program by evaluating how well the program keeps the public informed of facts and conditions related to the study, and particularly how conducive the participation sessions are to communication among citizens, experts and decisionmakers.

The committee is thereby not burdened with attempting to represent either the planning program to the public or the public to the planning process.

The involvement program began during a phase of the urban study called "need identification," and at that time we identified a broadly representative public that would be especially concerned about decisions resulting from the urban study. We began an outreach effort by gathering names of some people who, as private citizens, are active leaders in community affairs. The names gathered include noted individuals and officers of professional societies, business associations, environmental organizations, civic clubs, political

Flood control measures taken since the flood of 1951 make a repeat of any disaster of that severity unlikely.



organizations and educational groups. Periodically the Corps mails them notices of meetings, copies of issue papers, and even news releases about the study.

Part of our communication strategy is directed to the general public through mass media, including radio and television public service announcements. A radio message goes like this:

"The Good Life ...is brought to you by ...Water; W-A-T-E-R. That's right; good old Water—quenching your thirst, helping run factories and farms, keeping cities clean, transporting things from place to place, adding joy to outdoor vacations. WATER means a lot—in lots of ways. For the future of metropolitan Kansas City we can't go on just taking Water for granted. You can have a part in the thinking and deciding on future uses of Water in our area. For information call ..."

We installed a phone recorder to collect names and addresses of callers. We publicize it as a "code-a-phone" through the radio and television messages, and it has attracted people who might have hesitated to attend a meeting as a first step.

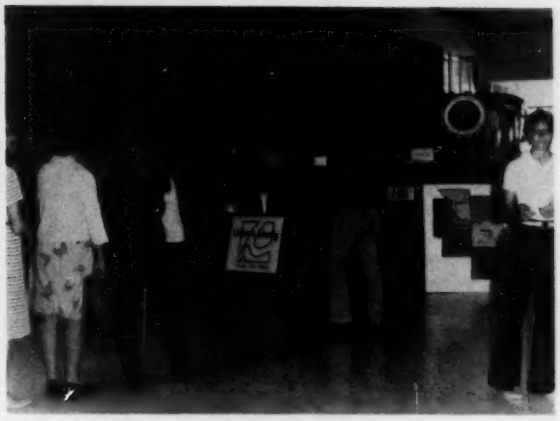
Both the radio and television stations provide opportunities for appearances on talk shows. These exchanges of views between citizens and experts give the general public a better appreciation of what public involvement in the study means and stimulates listeners to think about the issues and make up their own minds. Newscasts include information from our news releases as well as water issue items prepared by reporters. Newspapers throughout the eight-county region use the press releases and discuss the issues in editorials.

As a special event a "Water Week" was declared, featuring communication through various media. One method was to place displays at shopping centers, reaching people through today's version of the old town square. We took this traveling display to nine centers over a period of 4 weekends. At the display sites we

	OBJECTIVES		
Elements of Kansas City Public Participation Program	Identify public to be involved	Inform public	Obtain public ideas & perceptions
Public Involvement Committee	■	■	
List of public groups and individuals	■		
Brochures & information materials		■	
Press releases		■	
Radio & television appearances ("Talk Shows")		■	■
Radio & television public service messages		■	
Public workshops	■	■	■
Workshops & informal sessions		■	■
Appearances before organizations	■	■	■
Water Week displays	■	■	■
Code-A-Phone & response program	■	■	■
Field trips		■	■

The organizers of "Water Week" utilized this vintage ice truck as a touring display to attract the interest of citizens in the urban study.

Kansas City area residents become better informed about their water resources at a mobile display.



The Corps is bringing the urban water study to the public's attention by a variety of ways, one of them being walkway displays at popular shopping areas. The logo, at left, depicts the confluence of the Kansas and Missouri Rivers and coincidentally forms, in abstract, the letters K.C.

distributed over 4,000 brochures describing the urban study, and we collected a few hundred names of people who wanted to receive additional information or participate in group discussions.

Visual communication through a 10-minute slide presentation is another important method we use to get the message across. We use it repeatedly at public meetings to tell the story of the urban study in both words and pictures, making the study relevant to the lives and needs of people. We seek to humanize water planning by using pictures that identify the issues with people and their daily activities. In a similar vein, graphics help communicate ideas in a basic information brochure distributed through the mail, at the shopping centers and other locations.

Public perceptions on water-related problems and what the public wants done about them probably come through best, however, at local workshops. In these, usually attended by 25 to 50 people, subgroups of between 7 to 12 people discuss their concerns and these are compiled and reported back to the general assembly. Each subgroup selects its own spokesman. We find that subgroup size is important because less than 7 is too few for good interaction and more than 12 is too large to be truly functional. Also, each subgroup requires a moderator who can give everyone a chance to contribute while discouraging any one person from dominating the discussion. The comments and questions of these workshop subgroups are recorded by Corps personnel and the following indicate the range of interests in one such subgroup:

- "What would make the Missouri River suitable for

In the effort to inform the public and to attract its participation in the urban study, the Corps is holding a series of workshops and town meetings at which citizens can express their views and concerns.

recreation?"

- "To what extent do modern farming methods lead to increased flooding?"
- "Don't we need a complete soil survey of the region before land use considerations can be adequately analyzed?"

In another subgroup in that workshop a person contended that "further investigation should be made on the effect of urbanization increases on the water table and ground water."

Other concerns were: how to deal with urbanization of watersheds; sewage treatment; upstream irrigation; how individuals can solve water problems without relying on "Big Government"; how improved navigation would have an impact on the Missouri; and how to get more citizens interested in resource issues.

At all the workshops, Corps personnel are available to help in the discussions. These are members of the Corps who have participated in sessions on basic principles of human and group behavior. The basis for these sessions is transactional analysis, which serves as a guide to why people react differently in their transactions with others.

In the coming months Corps personnel will conduct an extensive campaign to discuss the study at clubs and community organization meetings throughout the metropolitan area. These meetings will offer occasions for citizen expressions. Other methods for public involvement will include a speakers bureau, field trips, dissemination of progress reports that can be accumulated and fit into a binder provided by us, and individual discussions with key people. Also, the Corps district will hold the traditional formal meetings that meet its own administrative requirements for public comment on the study.

Together these many modes of communicating with the public serve to create a better citizen understanding of issues and alternatives. The result is a broader representation of citizen attitudes from those who choose to participate directly in public involvement activities—and a flow of information to decisionmakers.

These participating citizens could possibly make up a constituency that would continue expressing a public view during subsequent stages of any plan and may serve in later years on planning boards and commissions. However such a constituency would be, at most, a small core of dedicated individuals because—despite the thousands who are becoming informed about water for Kansas City—only a few hundred make the effort to express their concerns and views.

It seems that some people will take the time to work on their community's problems while others won't. The reasons vary, but as one participant commented, "What you've got to remember is that for some people it's a depressing experience to try to get things done through groups and committees. To them the debate comes across as bickering. Not for some of us though. I'm 66, and I've always liked discussions. I enjoy opposition, enjoy finding out if someone can outthink me. And when they do, I usually gain something I can use in a later round."

Conceivably, such measures as free fish fries and rock concerts could entice greater numbers into coming out. Yet actual numbers are not in themselves indicative of impact.

What is important is that views expressed and consequently considered are not limited to vested interests but encompass the needs of a valid cross-section of the public. Even so, it is not likely that a public consensus will emerge on even a few of the water-related issues, but public involvement can bring the planner closer to reflecting public views—and that is a measure of success. Perhaps even more important, the growing public perception that water decisions are critical ones for the community to make is in itself a benefit.

Democracy, after all, works best in the glare of visibility. ■

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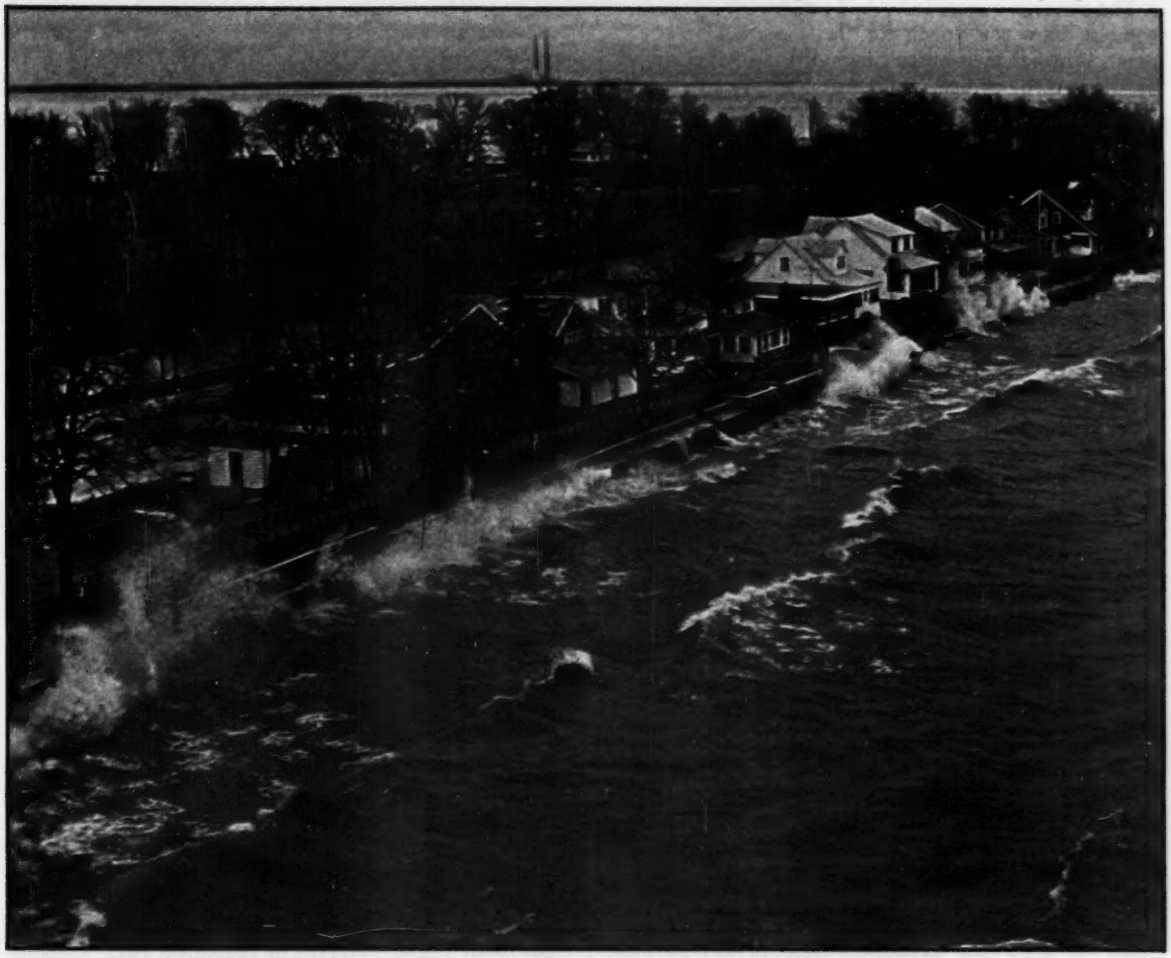

DEFENSE FOR A SHORELINE

by David R. Chenoweth

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Water-level fluctuations have helped shape the Great Lakes region for over 500 million years. In the Cambrian period, when shallow seas alternately flooded and ebbed as the land emerged, an arm of the ocean penetrated what is now the St. Lawrence River Valley. Along the way it created marine terraces which today measure 600 feet above sea level in some areas.

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In 1972 alone, almost 4.5 inches of precipitation above the normal 31 inches fell in the basin. On Lake Erie and neighboring St. Clair precipitation rose 14 percent above its normal average. By late summer, the accumulated effect of this excess water raised Lakes Erie and St. Clair a foot higher than normal.

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Fearing extensive flooding with the advent of the spring thaws in 1973, the Corps of Engineers North Central Division inaugurated "Operation Foresight on the Great Lakes" (OFGL) in December 1972. Modeled after the successful "Foresight" programs on the Mississippi in 1969 and in northern Michigan in 1971, the program aimed at helping threatened communities build temporary dikes where flooding could be expected during severe storms.

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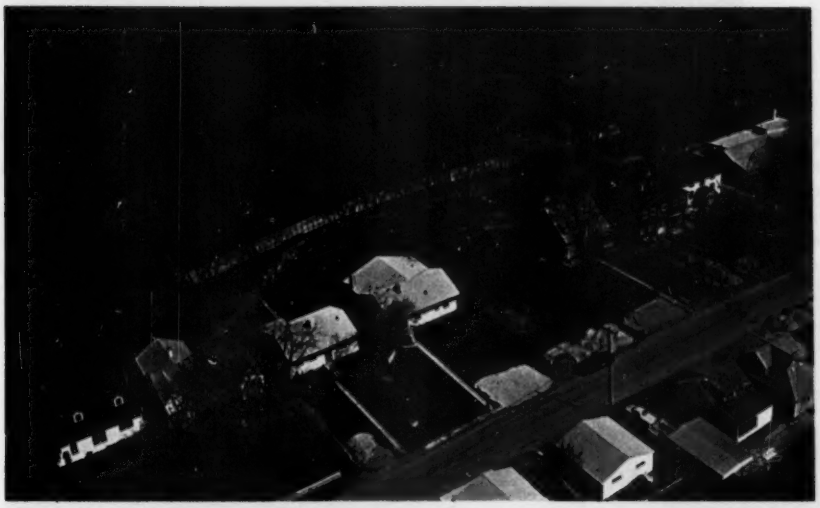

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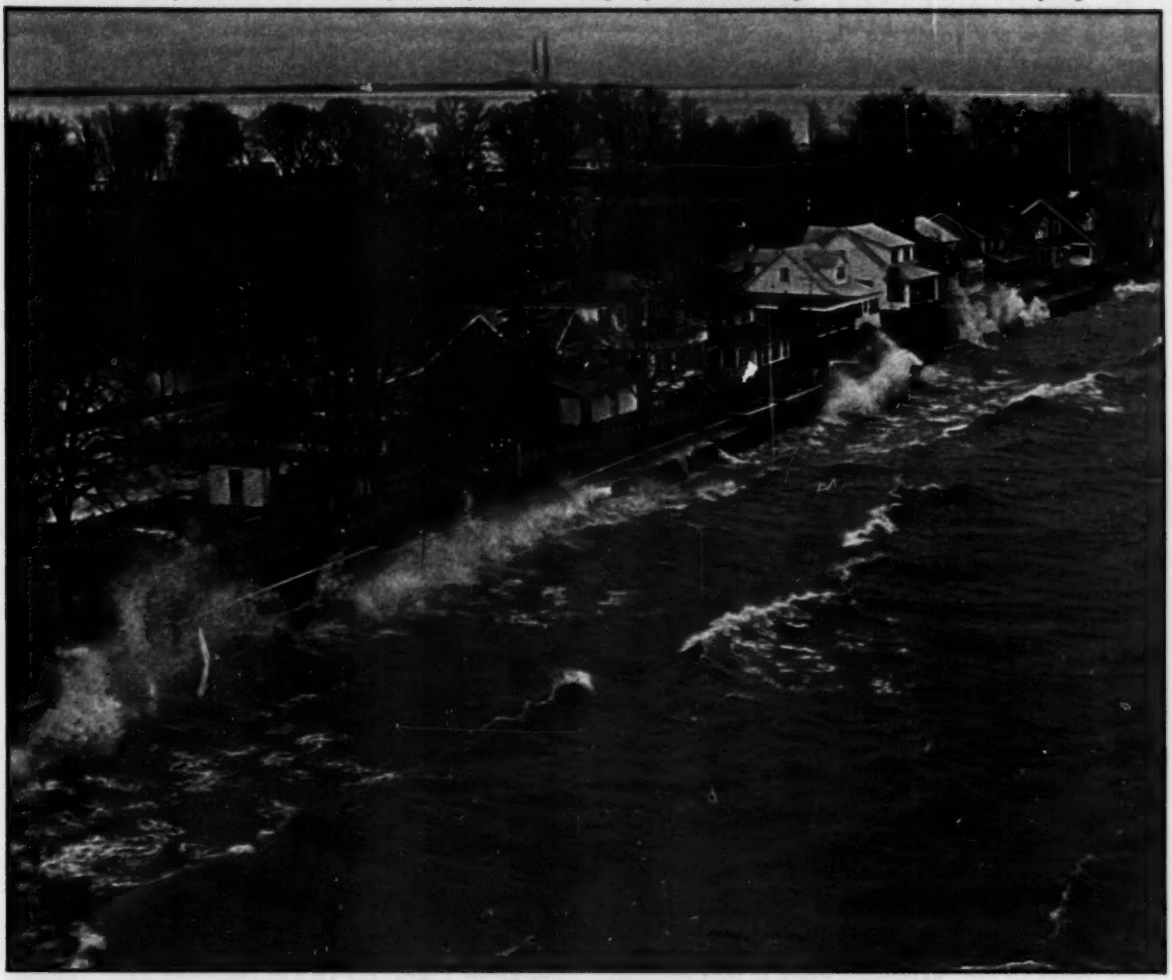

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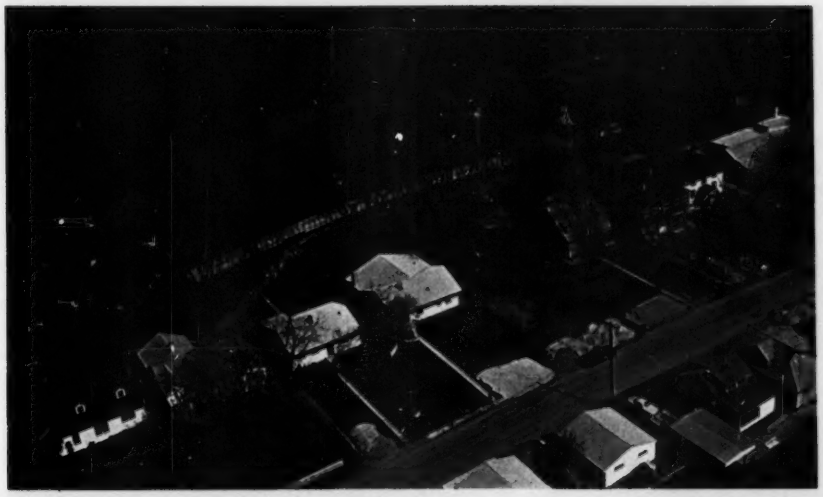

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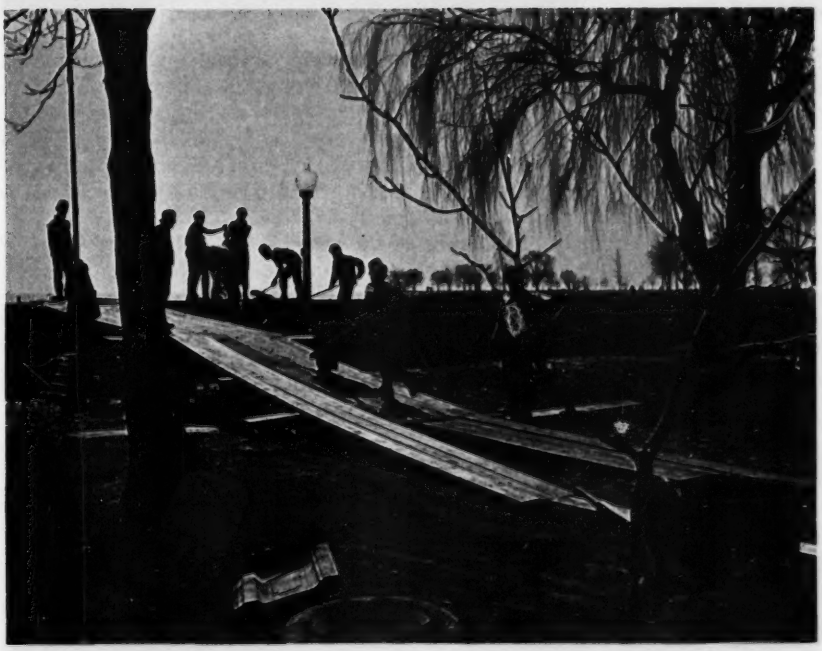

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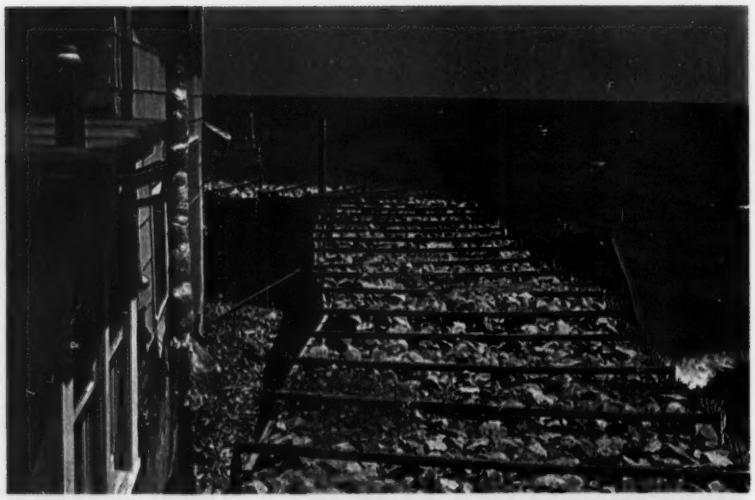

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Corps expended almost $18.6 million on 50 contract projects to protect an estimated $67.1 million in property.

Although the Corps had a greater role in these projects than in the material-technical assistance kind, local authorities were nevertheless responsible for a number of vital legal aspects regarding construction of dikes. The Corps required that local authorities (1) obtain the property easements and rights-of-way necessary for construction; (2) provide routine maintenance for the dikes once completed; (3) absolve the Corps from any legal liabilities connected with the dikes; and (4) assure the Corps that the dikes would be dismantled and removed once the crisis situation passed, whenever that might be.

According to Corps officials, the fourth requirement proved to be an inhibiting factor for many projects. Understandably, a number of communities considered prohibitive the cost of eventually clearing away what would have been, in some cases, miles of concrete, sand and rock.

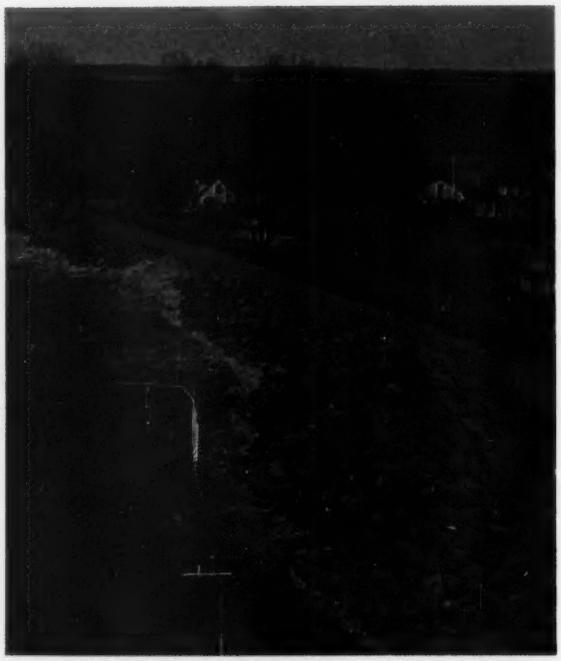
The emergency structures that sprang up on so many lakefronts ran the gamut of diking techniques. Project engineers tailored types and combinations of diking to the particular needs of each individual situation.

For example, because Lake Erie experiences heavy wave action, especially when the wind blows along the long axis of the lake, engineers designed rock cribs to counteract the waves' punishing effects. These boxlike enclosures of wire mesh, framed with metal or wood planking, were filled with small rocks and backed by plastic sheeting to prevent seepage. Their particular advantage is that the open mesh and rocks form a rough, porous surface that dissipates the force of the waves.

To prevent the undermining of foundations, they often used gabions, prefabricated wire mesh boxes filled with rocks. Gabions have the combined advantages of both rock cribs and sand bags, for their ability to dissipate wave force and ease and speed of deployment.

In areas where wave action is not so severe, they built sand crib dikes. Metal and wooden planks were used to form an open box, then the interior was filled with sand and topped off with sandbags or plywood. The primary area for "Operation Foresight" on Lake Huron was Michigan's Saginaw Bay, where winds blowing along the bay's longer axis have a tendency to sweep water as high as 8 feet above normal in some places, causing floods in low-lying areas. As a result, the most common structures on Saginaw Bay were old fashioned earth dikes constructed parallel to the shoreline. Because these dikes often blocked creeks running into the bay, culverts with one-way flaps were installed to allow creek drainage when the bay level receded.

As one might expect, these huge, hurriedly built structures, though necessary, are not elegant in appearance. And the sight of them looming along once pristine shorelines has caused considerable popular dismay. But, as in the recent case of Monroe County, the general attitude toward them became more tolerant after they proved their value by withstanding storm flooding. What had been "those ugly things" have become "our dikes." Intent on making the best of the situation, people beautified the dikes by painting the cribs, planting flowers around them, and setting up picnic tables. One local artist was inspired to create a mural on a crib wall.



An earth dike along Reno Beach, Mich., resists heavy wave action. A 2-day storm battered Monroe County last spring, causing over a million dollars in damage.

Both the United States and Canada have attempted, jointly or separately, to gain some control of fluctuating water levels in the Great Lakes and to a small degree have succeeded. Manmade channels and alterations of the natural outlet channels, as well as adjustable regulating works, have enabled engineers to alter lake levels. Such works have lowered the normal level of Lakes Michigan and Huron by almost a foot. Yet man is still unable to gain any great measure of control over this natural fluctuation.

Unfortunately, as of this past summer, meteorologists and engineers were still unable to predict when this most recent high-water period would again revert to moderate levels. In the meantime, the Corps is prepared to maintain the OFGL dikes against serious storm damage for as long as necessary. The cost of the program, by mid-1974, had reached $27,025,500 and provided protection for an estimated $88 million worth of property.

As for the future, that is best summed up by the *Monroe Evening News,* which told its readers last April 13th: "For the foreseeable future, the much maligned dikes will have to be depended upon to lessen flood damage. They have already proven to be of assistance providing they can be maintained. They are not perfect but they can help."■

Events, Deeds & Deliberations

Meandering at the Border

Even though the Rio Grande forms the border between Mexico and the United States, over the years the river has done what comes naturally—meandered. As a result lands previously north of the river are now south of it and lands formerly south of the river are now north of it.

It is up to the International Boundary and Water Commission, on which Mexico and the United States are represented, to reestablish the dividing line between the two countries. In December 1968, the Rio Grande in the vicinity of El Paso, Tex., was rechanneled,* establishing a new international boundary between the two nations.

Now another reach of the Rio Grande is to be rechanneled in accordance with the 1970 Boundary Treaty with Mexico. This time near Presidio and Hidalgo, Tex., about 200 miles southeast of El Paso, and about 55 miles west of Brownsville, Tex., respectively. Both countries have completed their surveys of the affected lands, and the center line for approximately 10 miles of new channel has been established. In fact, construction is scheduled to start in December 1974. Although relocating the river will result in hundreds of acres being shifted from north of the river to south of it and vice versa, none of the few small communities north of the Rio Grande near the lands to be shifted will be affected by the change. ■

*See "The Chamizal," WATER SPECTRUM, Vol. 2, No. 2, Summer 1970

A Sandy Rescue

A beach without sand is like . . . well, a beach without sand.

If this is a poor epigram, the possibility of its occurring was even less amusing to the people of Virginia Beach, Va., the popular ocean resort which wages a constant battle against erosion.

To combat the Atlantic's encroachment, the city requires 200,000 tons of sand each year. But in the past 3 years, threatened with a shortage of replacement sand, the Virginia Beach Erosion Commission has searched desperately for new sources of replacement sand. Formerly, it relied on hydraulic dredging from various locations near the beach.

The situation appeared even more serious last April when, after an offshore sand survey, the commission engineer warned that a period of severe erosion might be ahead.

Fortunately, Virginia Beach's need for sand coincides with the Corps of Engineers continuing dredging operation in the Thimble Shoals shipping channel at Hampton Roads in Chesapeake Bay.

The operation, which is carried out every 3 years to keep navigation lanes open, normally produces at least 2½ million tons of material, more than enough for Virginia Beach's requirements.

Therefore, the Corps began plans a year ago for pumping the dredge material 2½ miles from an ocean-going dredge at Thimble Shoals to Fort Story which adjoins Virginia Beach. From there the sand will be trucked to the beach for dispersal. The new operation is scheduled to begin this October.

City official George L. Hanburg termed the operation "a real rescue mission."

"I hate to think what might have happened to our beach," Hanburg said. "We simply had nowhere else to go for our sand." ■

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City's Land Subsides As Water Table Falls

According to the U.S. Geological Survey, more ground water is being pumped out of the underground basin in southeastern coastal Texas than is being added to the basin by percolation. Thus the land settles, the sea encroaches in places, and thousands of dollars in damage occurs.

At high tides, seawater from Galveston Bay flows through a residential area about 20 miles east of Houston. Some homes are now no more than 3 feet above sea level. This occurs because the area, near the confluence of the San Jacinto River and Buffalo Bayou, has sunk almost 8 feet since World War II. Even downtown Houston has subsided about 4 feet since World War II, and the maximum annual rate of subsidence from 1964 to 1973 was 2.5 inches.

To try to alleviate the problem, the City of Houston is providing another source of water—a reservoir, with a water delivery system scheduled to be completed in late 1975 or early 1976. The reservoir however may only be a partial solution. The amount of subsidence that will occur after delivery of the surface water begins will depend on the amount of ground water saved because of a cutback in its present use. The larger the cutback, the larger the volume of ground water saved and the lower the rate of subsidence. This decreased rate of subsidence will occur only in those areas where the cutback occurs. So where there is no cutback, subsidence will continue. ■

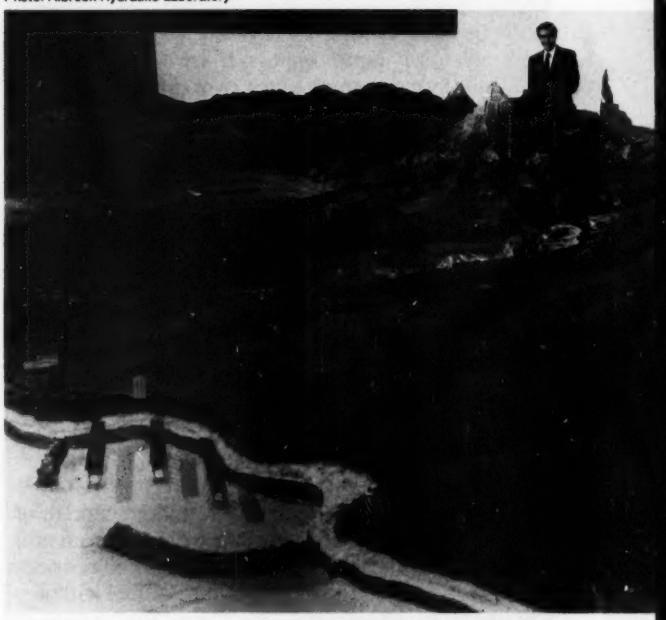
Followup

An article in an earlier issue of Water Spectrum (vol. 6, No. 1, 1974) discussed the development of Expo '74 at Spokane, Wash. This World's Fair, set amid the cascading waters of the Spokane River, uses the theme: Celebrating tomorrow's fresh, new environment. The fair opened in May with exhibits showing man and his progress in relation to the land, the water and the air.

Public response to this environmental fair is indicated by the attendance in June alone—more than 1 million people, nearly 10 percent greater than the projected total—from every area in the United States and several other countries. The fair has featured numerous activities, events and exhibits, including riding a mailboat up the Snake River, fishing for trout on the fairsite and even listening to the "Sounds of Nature"—birds singing, people talking, rushing water, blowing wind—in the Korean Pavilion. Twelve nations including the United States are sponsoring pavilions at the fair, which runs through November 3, 1974. ■

A cleaned-up Spokane River reflects the Expo '74 theme: "Celebrating tomorrow's fresh, new environment."

Photo: Albrook Hydraulic Laboratory



River basin development in the Pacific Northwest is depicted by this watershed model in the Water World Pavilion.

Visitors become acquainted with the relationship between man and the earth's resources—water, land and air.

Continued from inside front cover

waste money, natural resources and energy as well as wasting the waste material."

We know the research and other work by the noted professionals who wrote the series of wastewater articles are serving as a foundation for land treatment policy decisions at all levels. And we like to think that Spectrum has been an important instrument in communicating their ideas and conclusions to both peers and public.

The general change in attitude about land treatment eventually took official form with the Environmental Protection Agency's requirement, effective July 1, 1974, that any community applying for a grant to construct a waste treatment facility would have to show it had considered all alternative methods—including land treatment. The next Spectrum issue will discuss a city's actual experience in meeting this requirement.

Another timely treatment of an important topic came in the summer of 1971 when a Corps geographer, George Phippen, was among those exhorting colleagues and decisionmakers across the Nation to speed up improvements in the flood plain planning process. He said, "Basic to a broadened planning attitude is a recognition that the flood hazard is a *combination* of flooding and . . . flood plain use. Obvious?" he asked. "Apparently not, if one is to conclude on the basis of past . . . concentration almost exclusively on the flooding aspect and the means of preventing it. Flood losses are reducible by actions which modify both aspects; and neither aspect is considered superior to the other at the outset of planning."

The eventual acceptance of that concept was encompassed in the Water Resources Development Act of 1974, which endorses Federal participation with local interests in promoting nonstructural flood control measures. The act also calls for cost sharing comparable with that required for structural protection. To cover that and related flood plain policy matters, the next issue of Spectrum will present a review of opinions expressed and questions raised this year at the first National Conference on Flood Plain Management ever held. The article will explain why State, local and private interests generally feel that the public's welfare, as related to the flood plain, has as much right to be served as traditional property interests.

Not only have we attempted to foresee and cover domestic issues and changes which will emerge, we have also brought you articles about experiences in the water resources field abroad. Our series on foreign deep ports encompassed economic, engineering and environmental decisions abroad—the same type that are at the heart of issues currently being considered in determining United States policy. Other articles discussed environmental problems being encountered by various nations and their attempted solutions. Spectrum authors have also discussed the implications of the international technology exchange in the field of water resources, explaining its value to all participating countries.

The above examples by no means cover every major discussion that has appeared in Spectrum. In more general terms, we would have to characterize the contents as a broad range of water-related topics that have received more than passing attention among members of the water resources community. We have not only tried to capture the essence of issues in their incubation, but also to report on significant stages of maturity as each issue emerges into the limelight of heightened public concern. Our intent has been to—

- Generate an exchange of insights, ideas and useful information among agencies, institutions, organizations and individuals that engage in decisions affecting water resources.
- Convey insights, ideas and useful information that private citizens can use in reaching their own reasoned decisions and thus participate more meaningfully in the decisionmaking process.

These aims may appear ambitious, but there is ample evidence they are not beyond reach. And as I depart on a new venture and others take over the editorship, I feel fully confident they will bring you a product in keeping with the former Secretary's prediction: a magazine of growing importance in the field of water resources communication. It is already well on its way.

Editor

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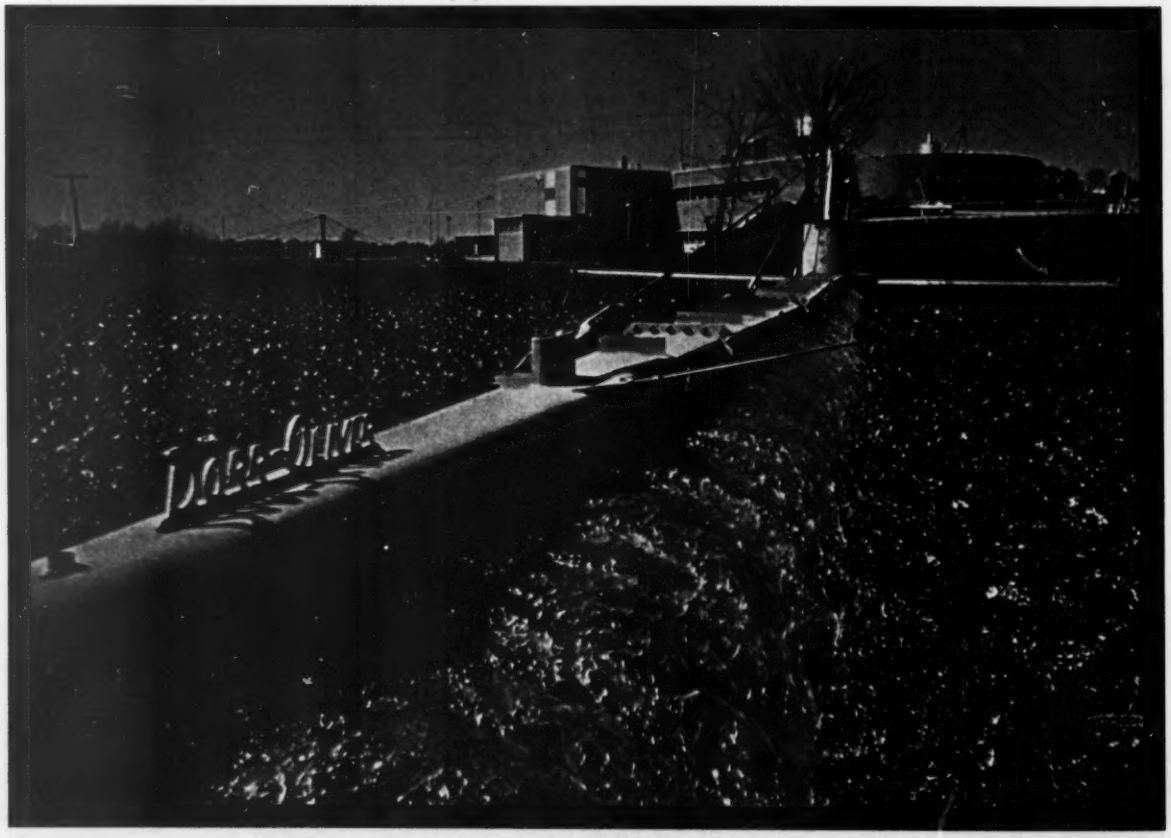
A city takes a searching look at its water needs. See page 34.